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Kentucky Utilities Company, Hancock County Generating Station Units 1 and 2 Technical Appendix, Volume I

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Atlanta, GA

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Atlanta, GA 30365

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16. Abstracts

Kentucky Utilities Company proposes to construct and operate two 650 MW capacity coal-fired electric generating plants adjacent to Ohio River mile 715 in northeast Hancock County, Kentucky. The EIS examines project alternatives, impacts and mitigative measures related to groundwater, air, surface water, ecological, and socioeconomic and cultural systems.

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PUBLIC NOTICE

U.S. Environmental Protection Agency
Region IV, Consolidated Permits Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365
404/881-7458

in conjunction with

Kentucky Department for Natural Resources and
Environmental Protection
18 Reilly Road
Fort Boone Plaza
Frankfort, Kentucky 40601

Public Notice No. PH81KY171 September 24, 1981

NOTICE OF PUBLIC INFORMATION HEARING

ON

DRAFT ENVIRONMENTAL IMPACT STATEMENT; NOTICE OF PROPOSED ISSUANCE OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT; AND NOTICE OF CONSIDERATION FOR STATE CERTIFICATION OF THE NPDES PERMIT

A Draft Environmental Impact Statement (EIS) will be made available by the U.S. Environmental Protection Agency (EPA) to the EPA Office of Federal Activities (OFA) and to the public on or about September 25, 1981, on Kentucky Utilities Company's proposed Hancock County Generating Station Units 1 & 2 to be constructed near Hawesville in Hancock County, Kentucky.

In order to solicit further public participation on the proposed issuance of necessary permits and determinations for the proposed project, a public information hearing will be held. The hearing is scheduled for November 5, 1981, and will begin at 7:30 p.m. at the Hancock County High School Gymnasium, Rural Route 1, Lewisport, Kentucky (halfway between Lewisport and Hawesville on U.S. 60). The hearing panel will include representatives from EPA, the Corps of Engineers (COE), and the Commonwealth of Kentucky.

Both oral and written comments will be accepted and a transcript of the proceedings will be made. For the accuracy of the record, written comments are encouraged. The Hearing Officer reserves the right to fix reasonable limits on the time allowed for oral statements.

The U.S. Environmental Protection Agency proposes to issue a National Pollutant Discharge Elimination System (NPDES) Permit to Kentucky Utilities Company, 120 South Limestone, Lexington, Kentucky 40507 for its Hancock County Generating Station Units 1 & 2 near Hawesville, Kentucky, NPDES No. KY0057606. The application describes four proposed discharges from construction and operation of the facility which will generate and transmit electricity, SIC Code 4911. The site is located adjacent to the Ohio River in the vicinity of river mile 716. Discharges will enter the Ohio River, Sandy Branch Creek, Muddy Branch Creek and Indian Creek all of which have been classified by the Commonwealth of Kentucky for All Uses.

The proposed NPDES permit contains limitations on the amounts of pollutants allowed to be discharged and was drafted in accordance with the provisions of the Clean Water Act (CWA, 33 U.S.C. Section 1251 et seq.) and other lawful standards and regulations. The pollutant limitations and other permit conditions are tentative and open to comment from the public both in writing and at the public hearing.

A fact sheet which outlines the applicant's existing and proposed discharges and EPA's proposed pollutant limitations and conditions is available by writing or calling the EPA. A copy of the draft permit is included in the DEIS and is also available from EPA. The administrative record, including the application, draft permit, fact sheet, environmental impact statement, comments received, and other information are available for review and copying at 345 Courtland Street, 2nd floor, Atlanta, Georgia, between the hours of 8:15am and 4:30pm, Monday through Friday. A copying machine is available for public use at a charge of 20¢ per page.

A preliminary determination regarding the Prevention of Significant Deterioration (PSD) permit under the Clean Air Act was issued on October 12, 1979, and a public hearing was held on July 22, 1980. Since the public hearing, additional information has been submitted for the PSD record. Consequently, a public notice announcing the re-opening of the public comment period for review and comment on this new information was issued on August 20 and 27, 1981. The comment period for the new information was for 21 days. Following the close of the PSD comment period and analysis and consideration of comments submitted, a final determination on the PSD permit will be formulated.

Persons wishing to comment upon or object to the Draft Environmental Impact Statement, NPDES permit issuance, the proposed permit limitations and conditions, or the State Certification of the NPDES permit are invited to respond in writing by November 13, 1981, to the U. S. Environmental Protection Agency, 345 Courtland Street, NE, Atlanta, Georgia 30365, ATTENTION: Mr. John E. Hagan III, P.E.; Chief, EIS Branch. The NPDES numbers, KY0057606 should be included on the first page of comments. All comments received by November 13, 1981, will be considered in the formulation of final determinations regarding the Final EIS, the NPDES permit and permit conditions, and the State Certification of the NPDES permit.

A Final EIS will be published after the close of the public comment period. The Final EIS will consist of a summary of the Draft EIS, the Agency's decision on this project, responses to comments received on the Draft EIS, the transcript of the public hearing, any other relevant information or evaluations developed after publication of the Draft EIS, and a proposed NPDES permit. A copy of the Draft EIS should be retained if a complete evaluation of the project is desired.

After consideration of all written comments and of the requirements and policies in the CWA and appropriate regulations, the EPA Regional Administrator will make determinations regarding permit issuance. If the determinations are substantially unchanged from those announced by this notice, the EPA Regional Administrator will so notify all persons submitting written comments or oral comments at the public hearing. If the determinations are substantially changed, the EPA Regional Administrator will issue a public notice indicating the revised determinations. Requests for an evidentiary hearing may be filed after the Regional Administrator makes the above-described determinations, but can only be based on issues raised at the Public Hearing or in writing during the comment period or where determinations are substantially changed as noted above. Additional information regarding evidentiary hearings is available in 40 CFR 124, Subpart E, 45 FR 33498 (May 19, 1980), or by contacting the Legal Branch at the address above or at 404/881-3506.

The Corps of Engineers will be represented at the public hearing to receive comments on their Section 10 and Section 404 permitting actions. The Corps of Engineers also will be issuing a public notice for this hearing.

The Kentucky Department for Natural Resources and Environmental Protection has been requested to certify the discharges in accordance with the provisions of Section 401 of the CWA . Comments on issuance of certification must be submitted to the state agency address above within thirty (30) days of the the date of this public notice. The state agency will co-chair the hearing in order to receive comments relative to state certification.

Copies of the Draft EIS, which includes the draft NPDES permit and permit rationale are available for review at the following locations:

Judge - Executive Office Hancock County Courthouse	Hawesville
Hawesville Mayor's Office City Hall	Hawesville
Cloverport Mayor's Office City Hall	Cloverport
Tell City Mayor's Office City Building	Tell City
Judge - Executive Office Breckinridge County Courthouse	Hardinsburg
Hancock County Public Library P.O. Box 249	Hawesville
Tell City Public Library 909 Franklin	Tell City

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PB82-128927

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30365

EPA 904/9-81-081a
September 1981

Environmental Impact Statement

Draft

Kentucky Utilities Company Hancock County Generating Station Units 1 & 2

Technical Appendix Volume I

PRODUCT OF:
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SPRINGFIELD, VA. 22161

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

EPA 904/9-81-057
NPDES Application Number:
KY 0057606

Draft
Environmental Impact Statement

for

Proposed Issuance of a New Source National
Pollutant Discharge Elimination System Permit

to

Kentucky Utilities Company
Hancock County Generating Station Units 1 & 2
Hancock County, Kentucky

Prepared by
U.S. Environmental Protection Agency
Region IV, Atlanta, Georgia 30365

Cooperating Agencies:

United States Army
Corps of Engineers
Louisville District
Louisville, Kentucky 40201

&

Kentucky Department for
Natural Resources and
Environmental Protection
Frankfort, Kentucky 40601

Kentucky Utilities Company proposes to construct and operate two 650 MW capacity coal-fired electric generating plants adjacent to Ohio River mile 715 in northeast Hancock County, Kentucky. The EIS examines project alternatives, impacts, and mitigative measures related to groundwater, air, surface water, ecological, and socioeconomic and cultural systems.

Comments will be received until NOV 13 1981

Comments or inquiries should be directed to:

Dario J. Dal Santo
EIS Project Officer
U.S. Enviromental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 881-7458

Approved by

for John A. Little, Deputy
Charles R. Jeter
Regional Administrator

AUG 18 1981
Date

Executive Summary
for
Environmental Impact Statement

Hancock County Generating Station Units 1 & 2
Kentucky Utilities Company

(X) Draft
( ) Final

U.S. Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

1. Type of Action: Administrative (X) Legislative ( )

2. Description of Action

Kentucky Utilities Company (KU) is proposing to construct and operate two 650 MW (net) capacity coal-fired steam electric generating plants in the Skillman Bottoms area of Hancock County, Kentucky. The EPA Region IV Administrator has declared the proposed plants to be new sources as defined by Section 306 of the Clean Water Act. Operation of these plants would require a National Pollutant Discharge Elimination System (NPDES) permit. Issuance of this permit would be a major Federal action significantly affecting the quality of the human environment and subject to the provisions of the National Environmental Policy Act (NEPA). Consequently, an Environmental Impact Statement (EIS) has been prepared.

As a public utility KU is obligated to efficiently provide adequate electric power to its service area customers. KU has conducted an evaluation of its ability to fulfill future electric power commitments and has determined the addition of a generating unit in 1989 and of a second unit in 1994 is essential to meeting projected future demands. KU's forecasted growth rate considers that through conservation measures, reductions in peakload and energy usage would be achieved. Accounting for planned purchases and conservation, a reserve margin of 12% would occur in the summer of 1989 without Unit 1. Forecasts show that without the addition of Unit 2 in 1994, KU would have only a reserve margin of 13% for the 1994 summer peak. There is a high probability that the forecasted load could not be served when outages or maintenance are required. KU's analysis indicates that neighboring utilities do not have surplus capacity available that could be purchased for lengthy periods of time. The Kentucky Public Service Commission has not made a recommendation on the need for Hancock County Units

1 & 2. Their review and decision process will follow release of this Draft EIS.

The proposed Units 1 & 2 and supporting facilities would be located on approximately 2350 acres in the Skillman Bottoms area of Hancock County, Kentucky (Figure 2.1-1). The proposed site is located on the Ohio River adjacent to river mile 715. Skillman Bottoms is approximately 4 miles east of Hawesville, Kentucky, 30 miles east of Owensboro, Kentucky, and 90 miles west of Louisville, Kentucky. The area is predominantly rural and land use is predominantly agricultural.

Major buildings and structures that would comprise Units 1 & 2 include the turbine hall and boiler complex, 4 electrostatic precipitators, flue-gas desulfurization (FGD) facilities, coal and limestone handling systems, a barge unloading structure, two 600-foot tall chimneys, two 60-foot tall mechanical draft cooling towers, and cooling water intake and discharge structures (Figure 2.1-2). Additionally, a wastewater treatment system is planned and approximately 669 acres would be utilized to dispose of the residual wastes generated by the power plant. The units would be operational for approximately 35 years.

Makeup cooling water for Units 1 & 2 would be drawn from the Ohio River. The cooling water intake structures would be equipped with offshore slotted screens. Approximately 12.4 million gallons per day (mgd) (average) and 21.8 mgd (maximum) would be required for cooling purposes. An additional 1.1 mgd of freshwater would be required for inplant uses. KU would obtain the freshwater from onsite wells.

An average of 10.5 mgd (maximum of 18.6 mgd) as evaporation and drift would enter the atmosphere from the cooling towers. Approximately 2.4 mgd (maximum) of plant effluents would be discharged to the Ohio River. Other water flows include percolation, consumption in the FGD system, and evaporation from the FGD system and wastewater treatment ponds.

Units 1 & 2 would burn approximately 3,000,000 tons of medium sulfur (3.5%) coal per year. Coal would be delivered to the site by barges at a rate of 6 to 7, 1500-ton capacity barges per day. A coal handling system, boiler design features, and air pollution control devices would combine to ensure that operation of the proposed units complies with applicable air quality regulations. Particulate matter would be controlled with electrostatic precipitators. Sulfur dioxide (SO_2) emissions would be controlled by tail-gas scrubbing using an FGD system. The formation of nitrogen oxides and carbon monoxide during combustion would be inhibited by the design and proper operation of the proposed boiler, furnace, and combustion air control system.

The solid waste stabilization system would treat bottom ash and pyrites from the steam generators, waste slurry from the SO_2 removal equipment, and flyash from the electrostatic precipitators. Dewatered FGD sludges would be combined with lime and flyash to produce a cementitious product. Approximately 1.25 million tons would be produced per year and landfilled in one of three onsite landfills which total 669 acres. The landfill sites would be developed in 25 acre parcels as needed.

Transmission facilities for the power plant would include an onsite 345 kV substation and transmission lines extending 5 miles (for Unit 2) and 10 miles (for Unit 1) south of the plant to existing transmission corridors. A new transmission line paralleling an existing line in the Elizabethtown corridor would be installed (Figure 2.1-3). This line would be approximately 45 miles in length and is needed to distribute power to Elizabethtown as the existing line is unsuitable for upgrading.

3. Major Alternatives Considered

A. Management alternatives (conservation, purchases of power, reactivating and uprating older units, and joint projects)

The Kentucky Public Service Commission (KPSC) which issues the Certification of Necessity and Convenience for power plants in the Commonwealth has not formally addressed the need for Hancock County Units 1 & 2. The KPSC will formally accept review of the need for this project after release of the Draft EIS.

For the EIS, alternatives were evaluated with regard to meeting KU's forecasted demands. KU does not have any retired units and uprating of existing units would not produce the amount of generating capacity projected to be required. Neighboring utilities have not been found to have sufficient capacity from which to purchase the needed power. Conservation measures to reduce peakload and energy usage were factored into KU's forecast analysis.

B. Energy source alternatives (nuclear, oil, gas, coal, hydroelectric, solar)

Major consideration was directed toward the state of the art of these technologies, fuel availability, application to the siting region, and construction time constraints. The proposed coal-fired units were selected as desirable based on environmental considerations (in conjunction with siting alternatives), available technology, national fuel use policies, and engineering, licensing, and construction lead times. Hydroelectric facilities of the capacity needed lack the requisite geological conditions in Kentucky, and the Powerplant and Industrial Fuel Act of 1978 generally prohibits the use of petroleum as the fuel source for power plants. Nuclear based generating plants require extremely long lead times for licensing and construction. The nuclear alternative would be more appropriate and economical for larger sized units (1000 MW) than the 650 MW units planned.

C. Siting Alternatives

A detailed siting analysis was performed by KU to identify potential sites and to assess their environmental and engineering suitability for a powerplant facility. This analysis identified the Hancock and Breckinridge County sites as the two preferred sites and KU proposed the Hancock County site for the powerplant.

For the purposes of the EIS, the 9 most favorable sites identified in the KU study were independently re-evaluated. This re-evaluation identified the Hancock and Breckinridge County sites and a site adjacent to the Green River as the most environmentally preferable sites. Of the three, the Breckinridge site appears to be the most environmentally preferable, although all sites are environmentally acceptable. The Green River site has been developed since the initial siting analysis was conducted.

D. Cooling system alternatives

Cooling alternatives evaluated included once-through cooling, cooling towers, and cooling ponds. Cooling water sources considered were the Ohio River and groundwater. Intake structures considered were onshore traveling screens, offshore slotted screens, and Ranney well structures.

Once-through cooling was rejected because of the associated adverse environmental effects (thermal and entrainment). An 1800 acre cooling pond would be needed for the cooling pond option and would require expansion of the proposed plant site. A wet-mechanical draft cooling tower was identified as an acceptable alternative on the basis of environmental, engineering and economic factors. Cooling water requirements would be minimized due to recycling of the cooling water, impingement/entrainment impacts would be minimized and thermal impacts would be reduced if cooling towers were used.

The Ohio River was considered the principal source of cooling water because of the quantities required. The offshore slotted screened intake structure was identified as the preferred alternative.

E. Wastewater treatment alternatives

Wastewater treatment and discharge systems were evaluated to assess meeting regulatory requirements and to maximize reuse of water. These alternatives were evaluated in conjunction with cooling system alternatives.

KU proposes a system of holding ponds with recirculation of the wastewaters for some plant water needs. Discharges to the Ohio River would result from cooling tower blowdown. Filtered runoff from stabilized sludge disposal areas also would be discharged to surface waters and is anticipated to meet water quality standards.

Discharge of cooling tower blowdown would require dilution to meet Kentucky water quality standards (KWQS) or to approach ambient river concentrations. (Ambient river levels of several substances exceed KWQS). A 100 foot mixing zone has been proposed to achieve a 100 to 1 dilution. Alternatives to the proposed system include reverse osmosis and precipitation of metal containing wastes prior to discharge. Because of the ambient river concentrations these were not considered reasonable alternatives.

F. Air emissions control alternatives

Air emissions control system alternatives were evaluated considering the state of the art of emission control technology, environmental impacts, and economics. Major SO_2 control alternatives included coal beneficiation and several FGD options. Major particulate control alternatives included fabric filters and electrostatic precipitators. Nitrogen oxides (NO_x) control alternatives included application of various combustion technology strategies.

KU proposes to utilize a limestone scrubber system to control SO_2, electrostatic precipitators to control particulates, and an off-stoichiometric combustion boiler to control NO_x. A Prevention of Significant Deterioration (PSD) permit application has been submitted. Air quality levels and increment consumption limitations would be met by KU's proposed systems.

Various alternatives for the control of fugitive emissions from the inactive coal pile were also assessed. Primary control measures include use of wetting agents (water & surfactants), screening, shaping, and enclosure. Enclosure and surfactants are considered the most efficient control technologies.

G. Residual waste disposal

Alternatives for flyash and FGD sludge disposal focused on marketing the waste and on several onsite disposal options (ponding, blending, stabilization). Stabilization (as a cementitious material) of these wastes is considered a viable alternative to minimize potential land use and leaching impacts. Recycling and reuse of these materials would be a preferred alternative.

H. Coal transport alternatives

There are three principal options available to transport coal to the Hancock site: rail, barge, truck. Barging has been determined to be the most desirable alternative. Trucking would require a tremendous number of haul vehicles, would add to traffic control difficulties on often poor quality roads, and would be economically unattractive. Transport by rail is economically and environmentally viable. However, because rail unloading facilities would need to be operated in close proximity to the Willamette bleached pulp mill and would constitute an unnecessary impact potential, this was not considered an acceptable alternative. Barging is economically and environmentally viable although construction of a docking facility on the Ohio River would be necessary and towing capability would need to be available 24 hours daily to provide adequate safety should a barge break loose from the docking facilities.

I. No-action alternative

A no-action alternative was evaluated to consider the effects and implications of not issuing an NPDES permit to KU for Units 1 & 2. Based on KU's projections, additions of a unit in 1989 and 1994 would be essential to meeting system needs. Neighboring utilities have not been found to have surplus capacity available that could be purchased for lengthy periods of time. The KPSC will formally review KU's need for power and make their recommendation following release of the Draft EIS.

Should system reliability on a long-term basis fall below actual demands, significant effects could be experienced by the consumers in the KU service region. These effects could include blackouts and potentially a decrease in the economic productivity and viability of the region.

Environmental impacts associated with ground clearing and loss of the current agricultural onsite land use would not occur as a result of the KU project if the facility were not permitted. Likewise impacts to air resources and water resources would not occur if an NPDES permit was not issued. Loss of potentially significant archaeological resources would be avoided if the permit were denied.

Because the Hancock site represents highly desirable industrial property, some development within the life of the proposed KU facility would be anticipated if an NPDES permit for the project were denied.

J. EPA's preferred alternative and recommended action

Pending a positive determination of need for the facility from the KPSC, EPA's preferred alternative would be construction of additional generating units. As defined in preceding paragraphs one such alternative specifies constructing two 650 MW power plants in the Skillman Bottoms area of Hancock County.

A major aspect of KU's project generating considerable comment and discussion has been the siting selection. Based upon the siting analyses and evaluations performed, the Skillman Bottoms site (Hancock County) is an environmentally acceptable site. The Holt Bottoms site (Breckinridge County) could be a slightly environmentally and economically preferable site alternative. However, a large 25,000 tons of coal per day synthetic fuel plant is presently proposed for construction and operation at this site. The Kentucky Department of Energy, through land purchase options, is making the Breckinridge site available for the synthetic fuel plant. The cumulative impacts of the synthetic fuel plant and the KU plant in the Holt Bottoms area although not fully assessed would likely (from an environmental and socioeconomic perspective) favor location of the KU facility at the Hancock County site.

A major economic concern of locating the KU plant in Hancock County would be the potential impact of coal dust on Willamette Industries' bleached pulp mill and fine paper plant adjacent to the proposed site. If sufficient quantities of fugitive coal dust impinge on Willamette's wood chip pile there could be a loss in the quality of the bleached pulp. This would impact the marketability of the pulp for fine quality paper products. At this time due to the lack of specific similar conditions and industry analyses, the exact frequency and significance of this potential impact is unknown. The best professional judgment is that there could be an influence on pulp quality but that this potential impact cannot be demonstrated by state-of-the-art air modeling and would be expected to be infrequent. Analysis also indicates this potential impact could be further mitigated. Without *in situ* demonstrations more specific conclusions cannot be reached. Measures which could alleviate this impact and appear possible include moving, covering, partially covering, and screening the wood chip pile or coal pile, and use of wetting agents and surfactants. Receipt of coal at the Hancock County Generating Station would commence about 1988 for a 1989 startup date, thereby allowing approximately 7 years for Willamette and KU to develop and implement a program acceptable to both parties which would protect each party's interests. Although such an activity is outside the scope of the NPDES and PSD permitting processes, it is EPA's judgment that this issue is not irresolvable.

Pending a positive determination of need for the facility from the KPSC, EPA would propose to issue an NPDES permit to KU for the Hancock County Generating Station Units 1 & 2 facility as proposed and as described in the Draft EIS. Several measures to mitigate environmental impacts of the project (in addition to those incorporated in the proposed project) have been identified during the NEPA process and have been included as Part III conditions to the NPDES permit. These measures are identified in the Mitigation Measures section of the Executive Summary (Section 5).

4. Summary of Major Environmental Impacts of the Proposed Project

The impacts associated with the facility would be a consequence of the collective interaction of the various system alternatives (fuel source, site, cooling system, air emissions control, residual waste disposal, wastewater treatment) identified with the proposed project. The primary emphasis of the assessment focused on identifying the nature and degree of the associated impacts and determining means to minimize adverse impacts.

Construction

The direct effect of constructing Units 1 & 2 and attendant facilities would be a commitment of 700 to 800 lowland acres for facilities development. An additional 669 upland acres would be required for residual waste disposal. Major terrestrial systems effected would include farmlands in the lowlands and wooded areas in the uplands. Cropland and pasture would be converted to industrial use resulting in the loss of appoximately 1479 acres. Possible and known prime farmlands comprise approximately 1050 acres on the site. Commitment of these lands to the KU project would represent a loss of a critical resource. Additionally, wildlife in these areas would be forced to relocate or more likely would be lost.

Approximately three 8-month periods would be needed to construct docks, intake and discharge structures, and shore facilities. This activity would increase turbidity and suspended solids levels and would disturb benthic communities in the area. The Corps of Engineers is presently evaluating an application for dredge and fill activities associated with construction of these facilities in the Ohio River. A decision on issuance of this permit is pending completion of the environmental review process.

Air quality would be affected by fugitive dust (particulates) during heavy construction activities. Dust suppression controls would be utilized to minimize these impacts. Additional air quality impacts can be expected from vehicle emissions associated with commuting of the construction force.

Construction of the facility would potentially disturb several archaeological (99) sites on the property. Further testing of 33 of these sites to determine their eligibility for the National Register of Historic Places has been recommended by the Kentucky Heritage Commission. Should these be declared significant sites several could be adversely impacted. Although these sites could be excavated prior to onsite construction, the long-term effect would be loss of the in situ archaeological character of the Skillman Bottoms area.

Because the proposed site is in a rural area and distant (30-90 miles) from major laborsheds, significant transporation problems may result during construction of the facility. The problem is compounded by the relatively poor condition of the onsite roads and the lack of an upgraded primary arterial between metropolitan areas and the site. Housing impacts may also occur if significant numbers of construction workers elect to relocate to the site area. However, relocation to the site area is not anticipated because of the generally short-term need for most trade types.

Socioeconomic impacts would potentially be greatly compounded should all major regional energy development undergo construction activities concurrently. Although 9 energy facilities (including 4 synfuel facilities) are planned in the region, concurrent development is not anticipated.

Positive economic stimulus to Hancock County would occur as a result of construction of these facilities. Hancock County income could increase as much as 4.4%. An estimated $3.1 million would be generated by the 1% Hancock County occupational tax during construction of the facilities.

Operation

Impacts of operation of Units 1 & 2 would primarily effect air resources and adjacent industry in the area. Additionally, impacts to groundwater and surface water resources and land use would result.

An average of approximately 12.4 mgd of Ohio River water would be required for cooling purposes. This represents 0.15% of the 7 day 10 year (7Q10) low flow for the Ohio River at river mile 715. A maximum of 21.8 mgd (0.26% of the 7Q10 low flow) would be withdrawn. Although entrainment/impingement impacts are expected, the low intake velocities (less than 0.5 feet per second), type of intake structure (offshore slotted screens), location of intake structures, and use of cooling towers will minimize these impacts. Aquatic studies in the vicinity of the Hancock site showed no consistent trends across the river nor with depth for distribution of fish eggs and larvae.

The maximum volume of effluents discharged to the Ohio River would be 2.4 mgd and would contain limited amounts of chlorine and trace metals. The maximum ambient Ohio River concentration of cadmium, mercury, iron, phenol, and cyanide currently exceed aquatic life criteria and discharge of these substances would therefore not meet the criteria. All effluents would meet the Kentucky Water Quality Standard of 44% of the acute LC_{50} criteria. The discharge structure has been designed so that a dilution of 100 would be achieved within a 100 foot distance downstream of the structure. Concentrations of pollutants at the edge of the 100 foot mixing zone would be less than six percent above ambient levels and would not be expected to result in a measurable impact to aquatic organisms in the Ohio River. The Commonwealth is presently evaluating whether this six percent increase would necessitate a variance. Chlorine (0.10 mg/l total residual chlorine), a biofouling agent discharged with the effluent, would meet water quality standards (0.01 mg/l) by the edge of the mixing zone.

The thermal component of the discharge would average 28°C (82°F) [maximum 35°C (96°F)] in the summer and 18°C (64°F) [maximum 20°C (69°F)] in the winter. A 1.1°C (2.0°F) isotherm would result at the edge of a dilution zone 15 meters (50 feet) downstream of the point of discharge.

Operation of barge facilities would contribute slightly to the silt movement in the river by resuspending silt from river deposits. A potential navigation hazard exists with barges breaking loose from the docking facility and striking Cannelton Dam downstream. To eliminate this hazard a reserve tug would conceivably need to be present 24 hours a day.

Impacts to the groundwater regime could occur in the form of leachate from the stabilized sludge (fly ash, bottom ash, FGD waste, lime) disposal areas, wastewater ponds, and coal pile. Primary constituents of the leachate would be acidity, trace metals, and dissolved solids. Movement of leachate would be toward the Ohio River due to natural groundwater flow.

The stabilized sludge is claimed to be generally non-leachable and data demonstrate minimal leachability. A groundwater monitoring program would be implemented prior to plant operation and would be designed to detect contamination of the groundwater. A condition to the NPDES permit stipulates that the wastewater ponds be lined with 2 feet of clay. This is generally considered adequate to retard leachate from reaching the groundwater. Should contamination occur, more stringent measures could be implemented to ensure no further contamination.

Principal atmospheric emissions from the facility would include NO_x, SO_2, and particulates. Dispersion of these emissions would be assisted by use of two 600 foot tall chimneys. A Prevention of Significant Deterioration (PSD) review has been conducted for this project. Based on this analysis, Commonwealth and Federal air quality standards would not be violated.

Extensive investigations are currently in progress toward understanding the globally significant acid rain problem. Sulfur dioxide (SO_2) emissions from Units 1 & 2 would potentially contribute to this phenomenon. The long term effect on acid rain production is unknown.

There is a potential for impacts to result to the Willamette bleached pulp mill and fine paper plant adjacent to the proposed site. Fugitive coal dust (in sufficient quantity) impinging on the Willamette wood chip pile could result in the quality of the bleached pulp being unmarketable for fine quality paper products. At this time due to the lack of specific similar conditions and industry analyses, the exact frequency and significance of this potential impact is unknown. The best professional judgment is that there could be an influence on pulp quality but that this potential impact can not be demonstrated by state-of-the-art air modeling and would be expected to be infrequent. Without in situ demonstrations more specific conclusions cannot be reached. Measures which could alleviate this impact and appear possible include moving, covering, partially covering, and screening the wood chip pile or coal pile, and use of wetting agents and surfactants. Willamette could experience revenue losses approaching $187,000 if a days production of bleached pulp is affected.

Impacts associated with use of cooling towers include increased fogging and icing and salt drift. Plume-induced fogging and icing would be limited primarily to onsite locations and areas of Skillman Road and the adjacent Louisville and Nashville Railway switchyard. Deposition of salt drift is expected to be most severe (1-25 tons/mile^2-month) within 500 meters (1500 feet) of the cooling towers. Offsite salt drift deposition is expected to be less than 1 ton/mile^2-month.

Operation of Units 1 & 2 would generate considerable residual wastes that must be disposed. The proposed onsite landfill that would be utilized represents a long-term commitment of this land and reduces the potential future uses of the land.

Operational impacts on the socio-economics of the area are generally expected to be beneficial. The complex is expected to generate 180 permanent positions (approximately 77 local hirees) and increase the local tax base by 75%, property tax revenues by 330%, and county revenues by 21%. In the long term the increased tax revenues would help improve social services. The proposed facility is compatible with Commonwealth and Area Development District plans for such sites along the Ohio River.

The exisiting public, medical, recreational, and cultural facilities within the surrounding areas would not be impacted by this facility. No significant noise impacts are anticipated.

5. Mitigation Measures

Several measures which would serve to mitigate the impacts of the proposed project on the surrounding environment were identified during the environmental review process. These measures are outlined below:

- Implement an erosion control and sedimentation program during construction to reduce potential water quality degradation from soil laden runoff.
- Monitor groundwater quality in the area during operation to determine whether more stringent waste disposal measures are needed.
- Line wastewater ponds with 2 feet of compacted clay to reduce potential leachate impacts to the groundwater regime.
- Limit corridor maintenance to use of EPA approved herbicides.
- Provide for a complete archaeological investigation of cultural sites on the Hancock site identified by the Kentucky Heritage Commission. Such investigation would include consultation with the Keeper of the National Register and the Advisory Council, as needed.
- Monitor sludge pond runoff during operation to verify and establish stabilized sludge runoff quality.

6. Unresolved Issues

- Ninety-nine (99) archaeological sites were identified on the Hancock County site. Of these, 33 sites were recommended for further testing by the Kentucky Heritage Commission (KHC) to determine National Register eligibility. This additional testing has not been undertaken since KU has not proceeded to purchase the property. If KU's decision is to proceed with purchase of the property, then the additional testing would be conducted in accordance with a protocol approved by the KHC.

  If necessary (if National Register quality properties are identified) EPA, KU, and the KHC would need to consult with the Advisory Council to identify a mechanism to preserve or excavate the sites.

- A house along the Elizabethtown corridor has been identified by the KHC as being potentially National Register eligible. EPA is currently pursuing consultation with the Keeper of the National Register for this site. If it is declared a National Register site, EPA and KU would need to consult with the KHC and, if necessary, the Advisory Council to identify a means to preserve the integrity of the site. This is not anticipated to be an issue since there is an existing corridor through the area and the plans call for upgrading of this corridor.

  Upgrading of the Elizabethtown corridor would necessitate widening of the corridor. Archaeological testing would be completed prior to upgrading activities. Testing and consultation (if necessary) would proceed as outlined in 36 CFR 800.

- Authorization for the disposal of stabilized scrubber sludge in the headwaters of onsite creeks would be, in EPA's opinion, a permitting action by the Corps of Engineers (COE) under Section 404 of the Clean Water Act, as provided in regulations promulgated by EPA on May 19, 1980. Prior to this date such disposal was subject to permitting by EPA under Section 402 of the Clean Water Act. Based upon the assessment in the Draft EIS, EPA would not object to the COE granting authorization for the filling of these headwater areas in a Section 404 permit.

  The COE also has determined that the disposal of this material, as presently proposed, is not within their jurisdiction. Consequently, this issue continues to be unresolved at the federal level. A Solid Waste Disposal Permit from the Commonwealth of Kentucky for disposal of these wastes will be necessary.

- The COE has expressed concern with the barge fleeting facility proposed by KU. Major concern relates to extension of the fleeting structures toward the Ohio River sailing line and the closeness of the facility to the Cannelton Lock and Dam.

  KU is currently redesigning the fleeting facility to alleviate COE concerns. Any design found to be acceptable would of necessity be an improvement on the degree of impact associated with the current design. Consequently, this is still an unresolved issue relative to COE actions in this project.

- The Commonwealth is presently evaluating whether a variance to Kentucky Water Quality Standards is necessary for those Ohio River water quality parameters which exceed the Standards and for which the concentration at the edge of the discharge mixing zone is less than six percent above ambient levels.

FOREWORD

Kentucky Utilities Company (the Applicant) proposes to construct two 708-megawatt (650 MW net) coal-fired steam electric generating units on a site near Ohio River Mile 715 in Hancock County, Kentucky. Distribution of power from the Hancock Generating Station will require a 3-circuit, 345-kilovolt transmission system. The Unit 1 transmission system will consist of a double-circuit, 345-kV tie into an existing east-west 345-kV transmission line about 10 miles south of the proposed station, near Victoria Crossroads, Kentucky. The Unit 2 transmission system will be constructed parallel to the Unit 1 double-circuit line to another existing east-west transmission corridor about 5 miles south of the station. It will be continued eastward in the existing corridor about 45 miles to Elizabethtown, Kentucky.

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) of 1969 (40 CFR 1500-1508) specify that the Draft Environmental Impact Statement (DEIS) is a summary document written to provide the decisionmaker and the public with critical and relevant information on the merits and demerits of a proposed action. EISs are to be analytic rather than encyclopedic and are to concentrate on significant issues rather than amassing detail. Emphasis in EISs is to be on issues of major significance; issues of lesser significance are to be addressed briefly. EISs are to be concise and no longer than necessary to comply with NEPA.

The format, content, and intent of this document follow CEQ and EPA implementing procedures by providing a DEIS that summarizes the major aspects of the Applicant's project, alternatives, and impacts. The major aspects summarized in the following sections of this DEIS are: purpose of the project and the need for action (Section 1.0); the alternatives considered, including the proposed action (Section 2.0); and the existing environment of the project and probable impacts to it (Section 3.0). In section 4.0, among other NEPA requirements, the unavoidable adverse impacts of the proposed action are summarized and commitments of resources by the project are identified.

Detailed technical information and impact assessments that support the major findings and conclusions presented in the DEIS are contained in a Technical Appendix. A limited number of copies of the Technical Appendix are available for review at these locations:

U.S. Environmental Protection Agency
EIS Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365

U.S. Army Corps of Engineers
Environmental Planning Branch
Attn: ORLPD-R
600 Federal Place
P. O. Box 59
Louisville, Kentucky 40202

Kentucky Department for Natural
Resources and Enviromental Protection
Office of Special Projects
Capital Plaza Tower
Frankfort, Kentucky 40601

Judge-Executive Office
Hancock County Courthouse
Hawesville, Kentucky 42348

Hawesville Mayor's Office
City Hall
Hawesville, Kentucky 42348

Hancock County Public Library
P. O. Box 249
Hawesville, Kentucky 42348

Judge-Executive Office
Breckinridge County Courthouse
Hardinsburg, Kentucky 40143

Cloverport Mayor's Office
City Hall
Cloverport, Kentucky 40111

Breckinridge County Public Library
P. O. Box 248
Hardinsburg, Kentucky 40143

Tell City Mayor's Office
City Building
Tell City, Indiana 47586

Tell City Public Library
909 Franklin
Tell City, Indiana 47586

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1.0 PURPOSE AND NEED FOR ACTION

Kentucky Utilities Company (KU) is required to deliver electric power to its customers under the regulations and statutes of the Kentucky Public Service Commission Law (Kentucky Revised Statutes, Chapter 278.025). The law requires that KU service any applicant who complies with the Commission regulations and KU's filed tariff. Thus, KU must serve both the present electrical demand and future electrical demand. Since the average time period for planning, permitting, and constructing a fossil-fuel steam electric generating unit is about ten years, long-term planning, including prediction of future needs, is necessary. KU's current prediction of future needs - its forcasted load demand - is the basis for the proposed electrical generating station.

1.1 THE APPLICANT

Kentucky Utilities Company is an investor-owned electric utility that was chartered by the Commonwealth of Kentucky in August 1912 and began service in the state in December 1912. KU services an estimated 334,000 Kentucky customers located in four service divisions - Western, Central, Mountain, and Bluegrass. A subsidiary, Old Dominion Power Company, headquartered in Norton, Virginia, provides service to 25,000 customers in southwestern Virginia. Corporate headquarters, as well as Bluegrass Division and Lexington offices, are in Lexington, Kentucky.

KU's current electric power capacity is 2178 MW, generated from seven major stations (Figure 1.1-1 and Table 1.1-1). With the addition of two generating units at the Ghent Station by 1984, KU's installed capability will increase to 3178 MW. The Ghent, Green River, and Brown generating stations, which are the most efficient and economical units, provide practically all of KU's routine base load, while less efficient units at the Tyrone, KU Park, and Haefling generating stations are used mainly for outages, maintenance periods, and above-normal load periods to provide peak power. Transmission facilities for power distribution include 3,800 pole miles of transmission lines, 12,000 miles of distribution lines, and 450 substations.

Electric power availability from other systems includes contract entitlements and agreements for short-term and long-term power transactions. Ownership of 20% of Electric Energy, Inc., which operates a 1008-MW plant near Joppa, Illinois, that supplies power to the U.S. Department of Energy (DOE) plant near Paducah, Kentucky, entitles KU to 20% of any capacity not required by DOE. Similarly, ownership of 2.5% of the 2250-MW generating capacity of the Ohio Valley Electric Company (OVEC), which supplies electric power to DOE's facility near Portsmouth, Ohio, entitles KU to 2.5% of the capacity not required to meet OVEC's contractural obligations to DOE. A contract with Owensboro Municipal Utilities (OMU) makes available to KU the capacity in excess of load and reserve requirements of OMU's Elmer Smith Units 1 and 2, which together have a net capacity of about 401 MW; KU purchased approximately 60% of OMU's 1980 capacity under this contract, which expires in 2000. Because KU can purchase power only in excess of other entities' needs, energy from these purchase agreements is not as reliable as that from KU capacity.

Interconnection agreements for various types of short-term and long-term power transactions (purchases and sales) exist among KU and 11 other companies, three of which joined with KU in 1971 to form the Kentucky-Indiana

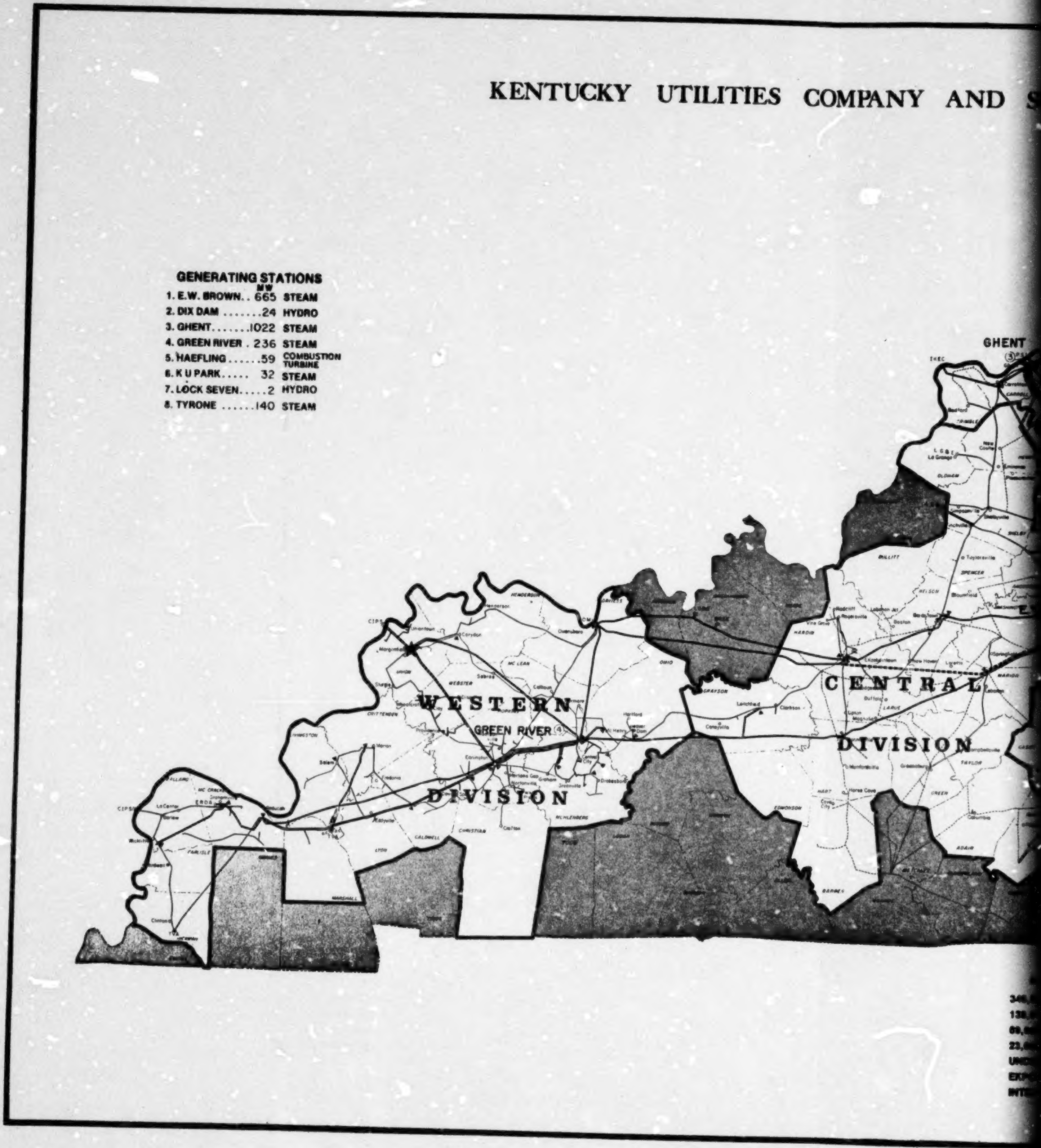
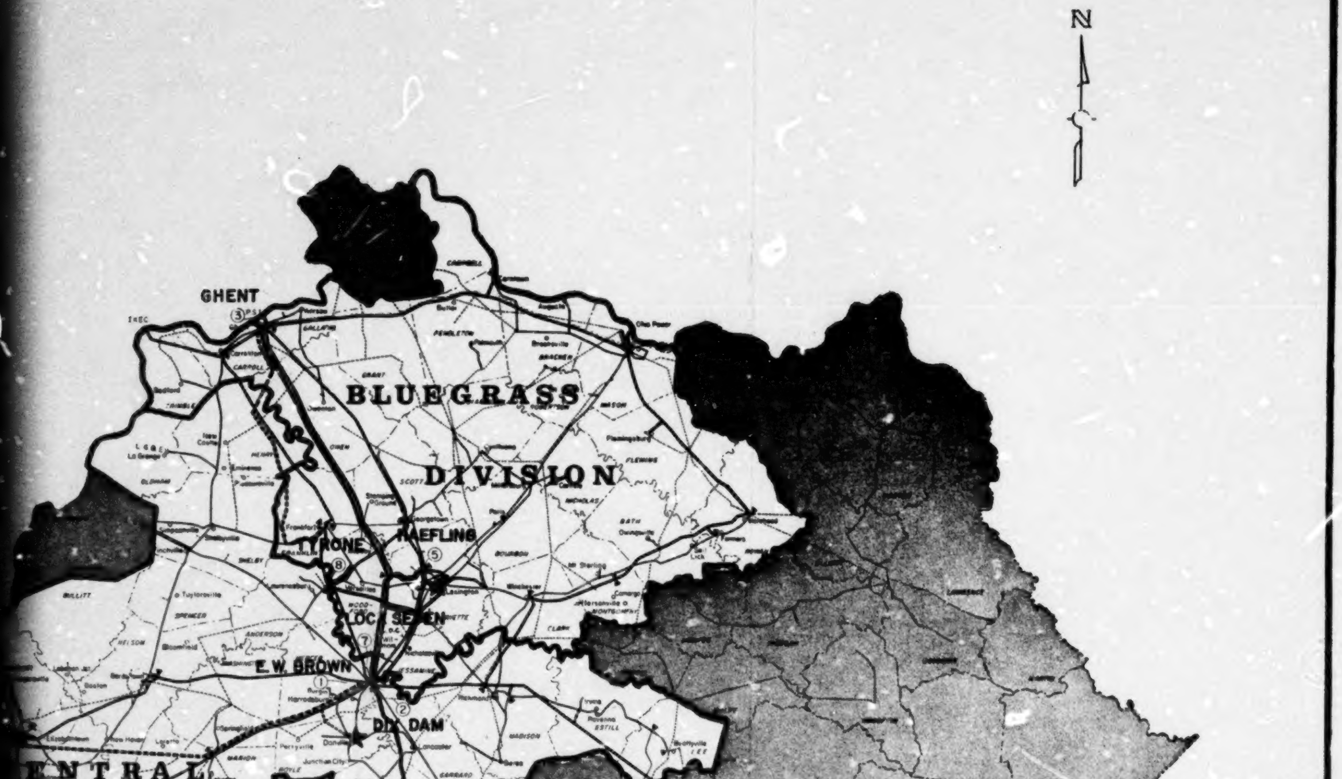

KENTUCKY UTILITIES COMPANY AND S
GENERATING STATIONS
MW
1. E.W. BROWN. . 665 STEAM
2. DIX DAM . . . . .24 HYDRO
3. GHENT. . . . . . .1022 STEAM
4. GREEN RIVER . 236 STEAM
5. HAEFLING . . . . . .59 COMBUSTION TURBINE
6. K U PARK. . . . . 32 STEAM
7. LOCK SEVEN. . . . .2 HYDRO
8. TYRONE . . . . . .140 STEAM
GHENT
WESTERN
DIVISION
GREEN RIVER
CENTRAL
DIVISION

Figure 1.1-1. Kentucky Utilities Generating Stations and Transmission Systems

MPANY AND SUBSIDIARY


N
GHENT
3
BLUEGRASS
DIVISION
TYRONE
8
HAEFLING
5
LOCK SEVEN
7
E.W. BROWN
1
DIX DAM
2
ENTRAL
DIVISION
MOUNTAIN
DIVISION
K U PARK
6
Old Dominion Power Company
TVA
LEGEND
ELECTRIC TRANSMISSION LINES
345,000 AND 500,000 VOLTS
138,000 AND 161,000 VOLTS
69,000 VOLTS
23,000 AND 34,500 VOLTS
UNDER CONSTRUCTION
EKPC
INTERCONNECTION POINT
RETAIL
WHOLESALE
TRANSMISSION SUBSTATION
DIVISION OFFICE
SCALE
MILES
KILOMETERS
DATE 6-1-80

SOURCE: Kentucky Utilities (1980)

Table 1.1-1. Kentucky Utilities Generating Stations

Station	Type	Fuel	Unit	Capacity (megawatts)	Total Capacity 1979/1984 (megawatts)
E.W. Brown	Steam	Coal	1 2 3	100 155 410	665
Ghent	Steam	Coal	1,2 3,4*	511 500	1022/2022
Dix Dam	Hydro	–	1,2,3	8	24
Green River	Steam	Coal	1,2 3 4	30 69 107	236
Haefling	Gas turbine	Gas/oil	1,2,3	20	59
K.U.-Park	Steam	Coal	1	32	32
Tyrone	Steam	Oil Coal	1,2 3	32 76	140
					2178/3178

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*Startup in 1981 and 1984, respectively.

Source: Kentucky Utilities Company (1980).

Pool (KIP). The objective of KIP has been coordination of planning and installation of generating stations and transmission systems of the four utilities to achieve reliable and economic operation with minimal reserve. Capacity planning within KIP recently terminated when Public Service Company of Indiana announced its intention to withdraw from the Pool. Long-term capacity commitments in KIP end in March 1982, although certain short-term transactions continue through March 1989. The Applicant anticipates renewal of interconnection agreements with KIP members prior to 1989 to continue use of existing transmission interconnection facilities.

In addition to the Hancock facilities, ongoing and planned KU generating and transmission projects include Ghent Generating Station Units 3 and 4 at Ghent, Kentucky; a 105-mile, 345-kV transmission line from the E.W. Brown Generating Station at Burgin, Kentucky to the KU Park Generating Station near Pineville, Kentucky; a 40-mile, 345-kV transmission system from Ghent to a new 345-/138-kV substation about 5 miles west of Frankfort; a 70-mile, 345-kV transmission system from E. W. Brown Generating Station to the Hardin County substation near Elizabethtown; and continuation of a 500-kV interconnection with Tennessee Valley Authority at the Virginia/Tennessee border to Pocket, Virginia and then to Pineville, Kentucky.

During 1980, total KU operations employed 1800 individuals (Table 1.1-2). Total operating revenues of $373.3 million were up 13% over 1979, in part because of rate increases put into effect during 1980. Electric sales to

Table 1.1-2. Kentucky Utilities Company Highlights, 1974-1980

	1974	1975	1976	1977	1978	1979	1980	% Difference 1979 to 1980
Operating revenues ($ million)	165.1	221.1	229.4	260.0	306.1	330.4	373.3	13.0
Net income ($ million)	13.3	24.3	25.7	21.7	21.5	30.8	26.7	-13.5
Earnings per average share of common stock ($)	1.63	3.18	2.78	1.99	1.88	2.60	1.51	-42.0
Dividends per share of common stock ($)	1.74	1.75	1.83	1.93	1.96	2.04	2.12	3.9
Construction expenditures ($ million)	57.1	84.3	84.6	71.1	89.1	139.8	175.2	25.4
Original cost of utility plant ($ million)	629.8	709.4	791.3	859.2	866.5	906.9	945.9	4.3
Sale of securities, long-term debt and capital stock ($ million)	48.0	54.2	51.6	41.0	44.5	114.2	134.3	17.6
Kilowatt-hour sales (million)	9,008.5	9,527.3	10,810.0	10,669.5	10,179.5	10,121.9	10,771.7	18.5
System peak demand in kW (thousands)	1,433	1,536	1,641	1,797	1,897	1,967	2,185	11.1
Average annual residential use (kWh)	7,633	8,406	8,806	9.831	10,178	10,021	10,692	6.7
Cost of fuel used in generation ($ million)	46.1	58.1	62.2	93.4	118.9	106.6	132.6	24.4
Number of employees	1,634	1,627	1,663	1,675	1,716	1,765	1,800	2.0
Average number of customers	315,521	322,076	331,000	340,000	342,105	350,480	357,048	1.9

Source: Kentucky Utilities Company (1980).

consumers increased over those of 1979. The hot summer of 1980 and the addition of new all-electric customers combined to increase average residential customer electricity use from 10,021 kWh to 10,692 kWh, which is above the 1979 national average of 8,833 kWh. System peak load increased 11% over that of 1979 to a record of 2.185 million kilowatts; this peak occurred in July 1980. Overall, KU's 1980 growth characteristics were somewhat higher than the depressed years of 1977 and 1978. Despite two rate increases during 1978 and one during 1980, KU's rates are among the lowest in the nation.

1.2 NEED FOR POWER

1.2.1 Growth in Peak Demand

Kentucky Utilities has planned the proposed generating station to avoid a forecasted deficit in its generating capacity in the early 1990s. KU's projection of future needs is based on both trends in peak demand and maintenance of adequate reserve capacity. Peak demand is the greatest demand for electricity during a single hour during a year. The utility must have the capacity to meet this demand to prevent brownouts. The utility must also maintain a reserve capacity above the peak demand for extraordinary contingencies such as system outages.

Depending upon the meteorological region, peak demand can occur as a summer peak or a winter peak. A summer peak results from air conditioning use during the hottest part of the summer, whereas a winter peak results from electrical heating during the coldest part of the winter. In KU's case, peak loads during these two seasons are approximately equal (Table 1.2-1). Large variations in apparent load growth from one year to the next are generally attributable to weather variations, economic conditions, or a combination thereof.

KU's annual summer load growth, expressed as an equivalent compound growth rate, or levelized rate, was higher from 1960 through 1973 (9.9%) than from 1973 to 1980 (5.9%). However, the winter load growth for the same two periods was constant (8.4%). The summer peak growth rate slowed during the 1973 to 1980 period because of customer conservation practices and a slowed economy. Although the winter season during this period had the same slower economic growth and conservation influences, the denial of natural gas service to new customers in 1973 raised KU's percentage of new all-electric residential customers from around 40% to 90%. Natural gas is again available, so that KU's percentage of new all-electric residential customers has declined to about 85%. This and circumstances influencing 1981 winter peak (coldest temperatures on Saturday rather than during the work week) produced a load growth for the winter of 1.9% over the previous summer peak. The winter 1980/81 peak was 2143 MW, which is a 9.5% increase over the 1979/80 winter peak.

The historic growth patterns of Kentucky Utilities' seasonal peak loads (Table 1.2-1) are shown on Figure 1.2-1, along with the projected winter peak loads from 1980/81 to 1993/94 and projected summer peak loads from 1981 to 1994. The Applicant expects the Jackson Purchase Cooperative, which it now serves, to be served by Big Rivers Electric Corporation by the end of 1983. The loss of this load represents approximately one year's load growth, as noted by essentially flat lines on the graph for that time.

Table 1.2-1. Kentucky Utilities Summer and Winter Peak Loads, 1960-1980

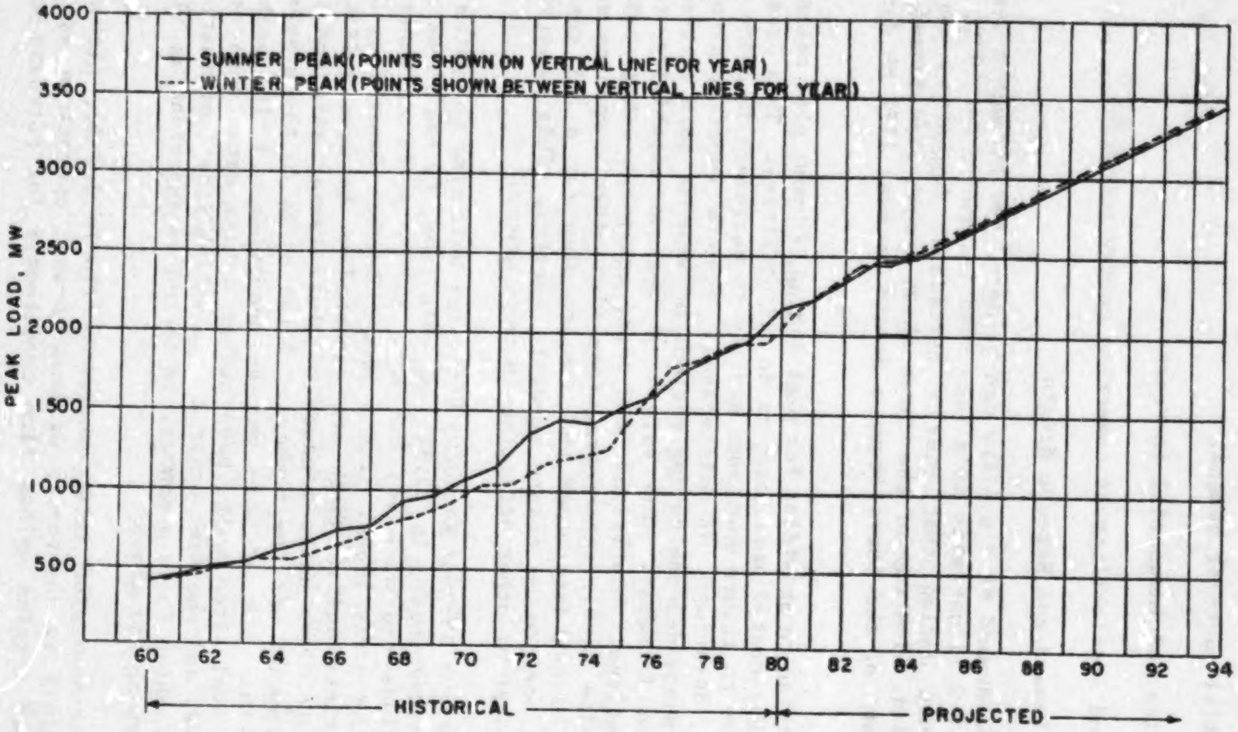
Summer Season	Actual Peak Load (MW)	Adjustment* (MW)	Adjusted Increase from Previous Year* (%)	Winter Season	Actual Peak Load (MW)	Adjustment* (MW)	Adjusted Increase from Previous Year* (%)
1960	489	63	–	1960/61	495	68	–
1961	522	61	8.2	1961/62	537	60	11.7
1962	584	66	12.4	1962/63	573	65	6.5
1963	583	49	3.1	1963/64	608	49	10.0
1964	665	54	14.4	1964/65	628	55	2.5
1965	727	61	9.0	1965/66	679	62	7.7
1966	781	14	15.2	1966/67	698	3	12.6
1967	789		3.9	1967/68	792		14.0
1968	937		18.8	1968/69	838		5.8
1969	979		4.5	1969/70	910		8.6
1970	1082		10.5	1970/71	1020		12.1
1971	1150		6.3	1971/72	1038		1.8
1972	1348		17.2	1972/73	1173		13.0
1973	1458		8.2	1973/74	1215		3.6
1974	1433		-1.7	1974/75	1282		5.5
1975	1536		7.2	1975/76	1514		18.1
1976	1610		4.8	1976/77	1797		18.7
1977	1795		11.5	1977/78	1845		2.7
1978	1897		5.7	1978/79	1920		4.1
1979	1967		3.7	1979/80	1957		1.9
1980	2185		11.1	1980/81**	2143		9.5
			8.5	Levelized – Annual Rate of Growth			8.4

---

[*] Between 1960 and 1966, Kentucky Utilities served 4 cities and 2 electric cooperatives that are now served by or are members of other utilities. Their loads were removed from peak load data to compare Kentucky Utilities' year-by-year growth rate through 1980 on an equal basis.

[**] 1981 to date.

Source: Kentucky Utilities Company (1981).



SOURCE: Kentucky Utilities (1981)

Figure 1.2-1. Kentucky Utilities Company Historical And Projected Seasonal Peak Loads

Factors influencing KU's estimation of customer requirements and future expansion are:

Peak load demand and reserve margin.

Residential customer demand.

Population and industrial increases.

Price and availability of competing energy resources.

1.2.2 Peak Load Demand and Reserve Margin

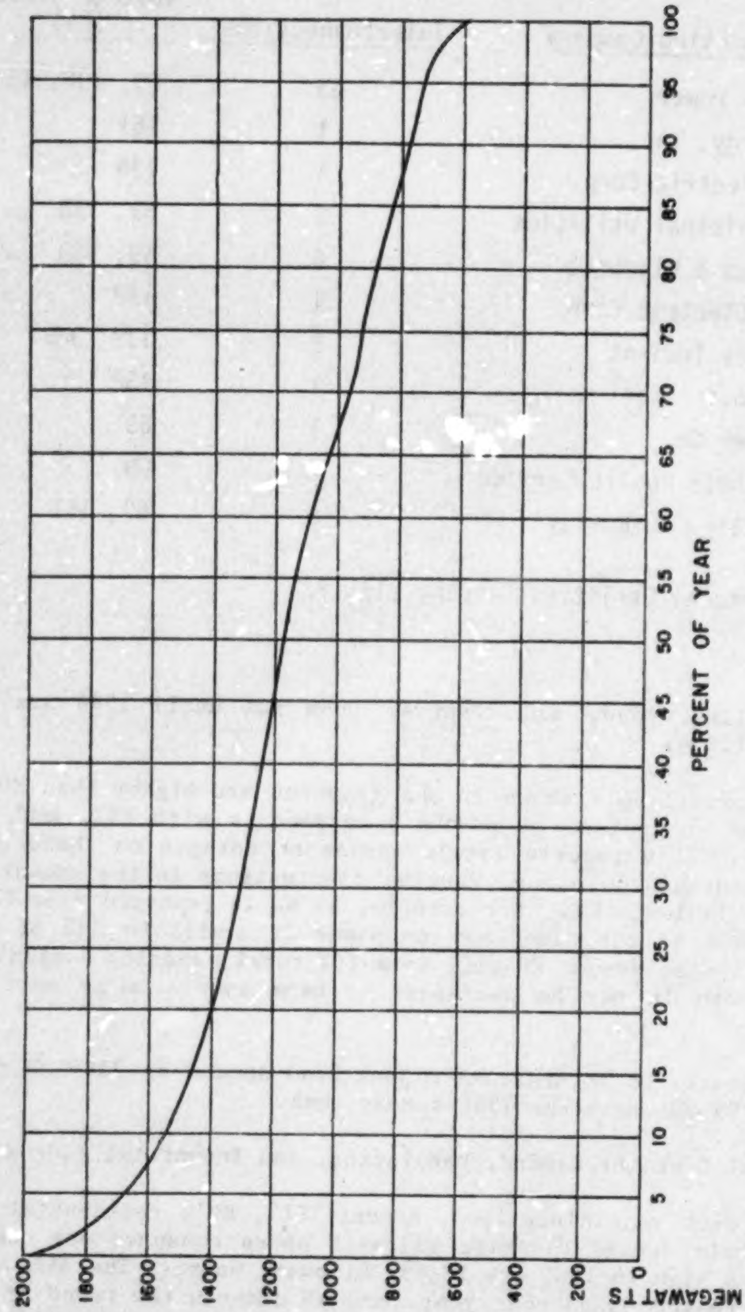
The load demand of a utility can be described through a load duration curve. Figure 1.2-2 illustrates KU's load duration curve for 1979, giving the percentage of hours during that year a particular demand in megawatts was reached or exceeded. The top of the curve shows a peak load demand of 1967 MW and the middle part of the curve shows a demand of over 1172 MW during 50% of the year.

In addition to providing for peak demand, KU must plan reserve capacity in excess of its forecasted peak load, as do all utilities. This excess capacity provides a reserve to insure continued service to customers in cases of generating unit outages, deratings, or maintenance. Reserve capacity also is used in the case of increased demands during periods of weather more extreme than that used for the load forecast. The margin of reserve capability is based on several considerations: historical load data, equipment outage rates, largest unit to system size ratio, interconnections with other companies and changing load patterns. KU has determined the need to plan for a 20% reserve margin during peak load periods to ensure adequate service. This reserve margin is consistent with that of other utilities in the country.

The current largest Kentucky Utilities unit size to system load ratio, using the 1980 summer peak, is 23.9%. At this time, KU has three units in the 400 to 500-MW class and will add two more 500-MW units at Ghent Generating Station during the early 1980s. The proposed Hancock Generating Station will add two 650-MW class units, which are expected to be less reliable than the Applicant's 500-MW class units because of their larger size and the required SO_2 removal equipment. As the number of large units on the system increases, the probability that one or more may be unavailable during peak conditions will increase. Coal-fired units have higher outage rates than other similar fossil-fuel units, and the East Central Area Reliability Coordination Agreement Group (ECAR), of which KU is a member, is currently experiencing 30% generation unavailability among the group.

KU's transmission interconnections (Table 1.2-2), although several, are valuable mainly in day-to-day or week-to-week operations and have little effect on planned margins unless firm commitments for purchase are possible.

Figure 1.2-3 shows how KU plans to meet its peak load demand through 1994, with Ghent Units 3 and 4 and Hancock Units 1 and 2 on-line. Installation of new units and power purchases will allow KU to meet demand, ensure reliable service through adequate reserves, and have the capacity to conduct periodic maintenance on its larger units during off-peak loads in spring and fall. KU's



SOURCE: Kentucky Utilities (1981)

Figure 1.2-2. Kentucky Utilities 1979 Load Duration Curve

Table 1.2-2. Kentucky Utilities Company Interconnections, 1981

Interconnecting Company	Interconnections	Voltage Classes (KV)
East Kentucky Power	33	69, 138, 161
Electric Energy, Inc.	1	161
Big Rivers Electric Corp.	1	138
Owensboro Municipal Utilities	2	69, 138
Louisville Gas & Electric	4	69, 138
Ohio Valley Electric Corp.	1	138
Public Service Indiana	2	138, 345
Ohio Power Co.	1	138
Kentucky Power Co.	1	69
Central Illinois Public Service	2	69
Tennessee Valley Authority	5	69, 161

Source: Kentucky Utilities Company (1981).

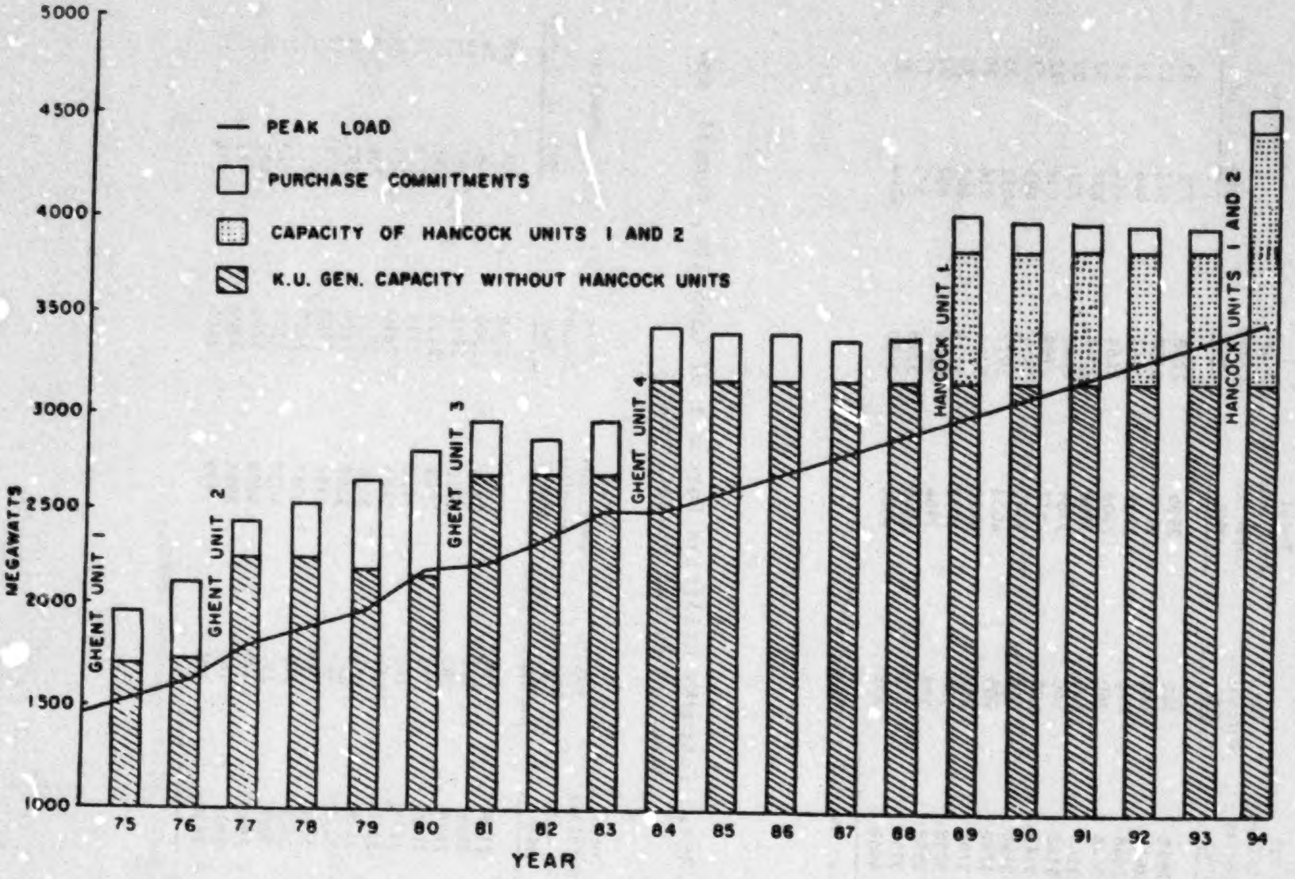
forecasted capability, load, and reserves from now until 1994 are shown in Tables 1.2-3 and 1.2-4.

The reserve levels shown in the graphics are higher than KU actually expects because of the nature of purchase agreements with EEI, OMU, and OVEC (see Section 1.1). KU's reserve levels assume no outages on these utilities' systems, whereas outages do occur, causing fluctuations in the amount of electrical energy available to KU. For example, 55 MW is expected from EEI 32% of the time, 21 MW 40% of the time, and no power is available 28% of the time. The reserve levels also assume KU will have its total capacity available during peak loads, although it may be necessary to have even a major unit down for maintenance.

KU presently is forecasting a peak load demand of 3480 MW for summer 1994. This is 1295 MW above the 1980 summer peak.

1.2.3 Residential Customer Demand, Population, and Industrial Increases

During each year since 1965, except 1979, KU's residential customers have increased their demand (average kilowatt hours consumed per customer per year). The record high in 1980 was 10,692 kilowatt hours. The mild weather of 1979 probably decreased usage that year, and KU expects the trend of increased usage to continue despite the dampening effects of conservation, inflation, and general state of the economy. Although the percentage of new all-electric residential customers will slow, KU expects its percentage of these customers to remain above pre-1973 levels. With the current upswing in Kentucky's population growth, KU expects residential customer growth to continue at about 2.4% annually.



SOURCE: Kentucky Utilities (1981)

Figure 1.2-3. Kentucky Utilities Capability, Capacity and Peak Load, Historical 1975-1980, Projected 1981-1994

Table 1.2-3. Kentucky Utilities Forecast of Capacity, Demand, and Reserves During Summer Peak

Year	Total Installed Capacity (MW)	Net Purchases (MW)	Total Available Capacity (MW)	Peak Demand (MW)	Reserves (MW)	Reserves (% of peak)
1981	2648	341	2989	2218	771	35
1982	2648	280	2928	2350	578	25
1983	2648	271	2919	2463	456	19
1984	2648	260	2908	2464	444	18
1985	3148	250	3398	2566	832	32
1986	3148	240	3388	2667	721	27
1987	3148	229	3377	2769	608	22
1988	3148	218	3366	2871	495	17
1989	3798	205	4003	2972	1031	35
1990	3798	192	3990	3074	916	30
1991	3798	180	3978	3175	803	25
1992	3798	166	3964	3277	687	21
1993	3798	151	3949	3378	571	17
1994	4448	136	4584	3480	1104	32

Source: Kentucky Utilities Company (1981).

Table 1.2-4. Kentucky Utilities Forecast of Capacity, Demand, and Reserves During Winter Peak

Year	Total Installed Capacity (MW)	Net Purchases (MW)	Total Available Capacity (MW)	Peak Demand (MW)	Reserves (MW)	Reserves (% of peak)
1980-81	2178	594	2772	2168	604	28
1981-82	2678	172	2850	2300	550	24
1982-83	2678	280	2958	2411	547	23
1983-84	2678	271	2949	2412	537	22
1984-85	3178	260	3438	2511	927	37
1985-86	3178	250	3428	2610	818	31
1986-87	3178	240	3418	2710	708	26
1987-88	3178	229	3407	2810	597	21
1988-89	3178	218	3396	2908	488	17
1989-90	3828	205	4033	3008	1025	34
1990-91	3828	192	4020	3107	913	29
1991-92	3828	180	4008	3206	802	25
1992-93	3828	166	3994	3306	688	21
1993-94	3828	151	3979	3405	574	17

Source: Kentucky Utilities Company (1981).

Kentucky growth in manufacturing employment has slowed since 1974. The current recession's impact upon Kentucky is readily apparent: July 1980 manufacturing employment was 90.6% of the 1974 level. Much of this decrease is outside KU's service area. If the current recession ends and economic recovery occurs in 1981, and if Kentucky experiences industrial growth, KU's load forecast may require upward adjustment. The Applicant expects industrial growth to resume in Kentucky. The state is centrally located, has an excellent transportation network, has adequate water resources, and expects, because of its coal resources, to be a competitive electrical energy supplier for industry that may be considering locating there.

1.2.4 Generation, Purchases and Sales

The complex system of electrical energy sales and purchases for Kentucky Utilities is explained through an input-output diagram for 1979 (Figure 1.2-4), which shows power generated and sold by KU (white blocks) and that purchased from or sold to other utilities (shaded blocks). KU's mix of system sales for 1979 shows commercial and industrial as the largest portion (43.6%) and residential and rural sales second largest (36.2%).

The quantity of purchases and sales from and to other utilities changes continually because of outages, as mentioned, and other factors. Long-term transactions span a considerable length of time and generally are agreed on months or years in advance. Short-term transactions are mainly dependent upon the operating status of the system and may be used to cover short-term outages for economic reasons or to conserve natural gas or oil fuel. A major unit outage requiring the purchase of additional power could create a critical situation should it occur during peak loads. During non-peak loads, KU's reserves could cover the loss of a major unit unless another one was down for maintenance.

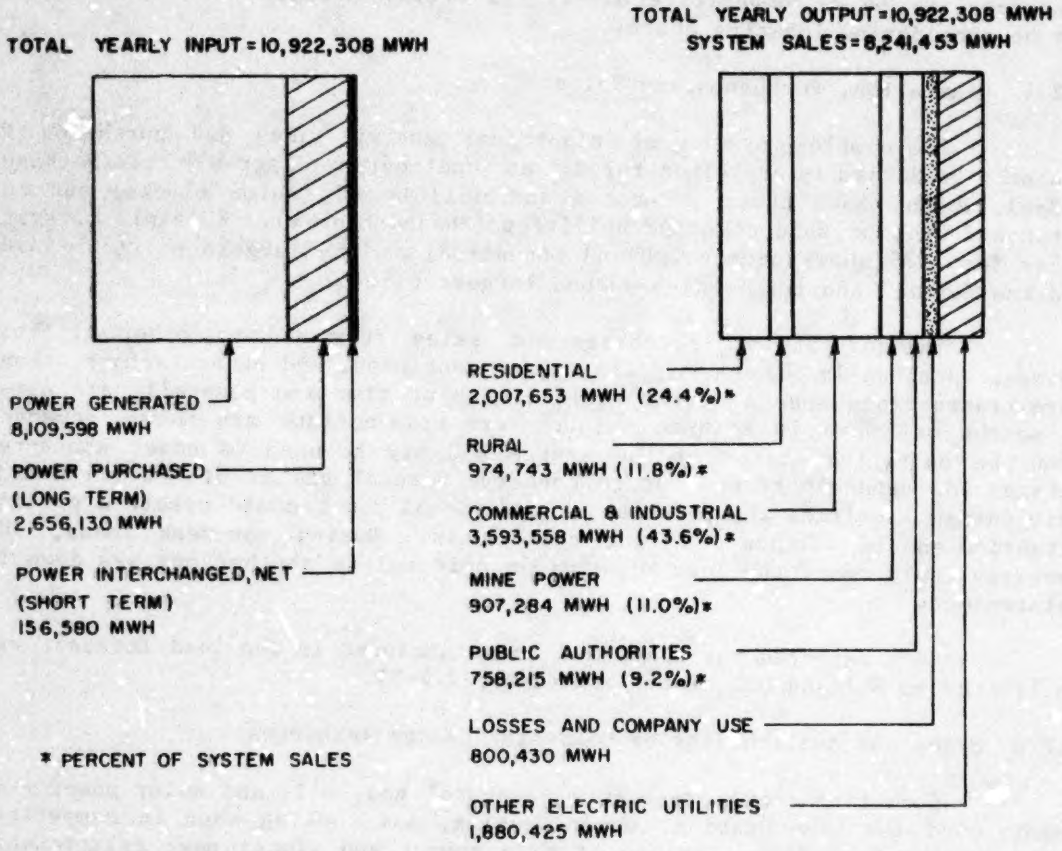
KU's expected purchases and sales included in the load forecast will be limited to EEI and OMU after 1982 (Table 1.2-5).

1.2.5 Price and Availability of Competing Energy Resources

Competing energy resources - natural gas, oil, and solar power - are mainly used for home heating, water heating, and cooking when in competition with electrical energy. Because of KU's summer and winter peak relationship, both summer and winter loads must be impacted to affect load growth and reduce capacity additions.

Natural gas usage is influenced by several factors, including recent price adjustments for imports, the expense of presently unregulated domestic reserves, and the anticipated rise in prices of other domestic reserves when deregulated by 1985. Deregulation is expected to make the price of natural gas equal to or greater than that of oil on the basis of comparable dollars per million Btu, because it is a cleaner fuel and not as subject to embargo. Also, because natural gas still is restricted to users of large quantities (e.g., industry) and is used mainly for hot water and cooking in residences, KU does not expect increased availability to decrease its summer peak.

Oil prices currently are climbing faster than electricity prices. This, in addition to any future problem with availability, likely would cause


TOTAL YEARLY INPUT = 10,922,308 MWH
POWER GENERATED
8,109,598 MWH
POWER PURCHASED
(LONG TERM)
2,656,130 MWH
POWER INTERCHANGED, NET
(SHORT TERM)
156,580 MWH
* PERCENT OF SYSTEM SALES
TOTAL YEARLY OUTPUT = 10,922,308 MWH
SYSTEM SALES = 8,241,453 MWH
RESIDENTIAL
2,007,653 MWH (24.4%)*
RURAL
974,743 MWH (11.8%)*
COMMERCIAL & INDUSTRIAL
3,593,558 MWH (43.6%)*
MINE POWER
907,284 MWH (11.0%)*
PUBLIC AUTHORITIES
758,215 MWH (9.2%)*
LOSSES AND COMPANY USE
800,430 MWH
OTHER ELECTRIC UTILITIES
1,880,425 MWH

SOURCE: Kentucky Utilities (1981)

Figure 1.2-4 Input-Output Diagram, Kentucky Utilities, 1979

Table 1.2-5. Forcast of Net Purchases During Summer and Winter Peaks for Kentucky Utilities Company, 1981-1994

Summer	Net Purchase (MW)	From Company (MW)*
1981	341	OVEC 21, EEI 145, OMU 233, EK 29, IPL-87
1982	280	OMU 225, EEI 55
1983	271	OMU 216, EEI 55
1984	260	OMU 205, EEI 55
1985	250	OMU 195, EEI 55
1986	240	OMU 185, EEI 55
1987	229	OMU 174, EEI 55
1988	218	OMU 163, EEI 55
1989	205	OMU 150, EEI 55
1990	192	OMU 137, EEI 55
1991	180	OMU 125, EEI 55
1992	166	OMU 111, EEI 55
1993	151	OMU 96, EEI 55
1994	136	OMU 81, EEI 55

Winter		
1980-81	594	OVEC 13, PSI 11, EK 175, OMU 240, EEI 155
1981-82	172	EEI 55, OMU 233, EK-29, IPL-87
1982-83	280	OMU 225, EEI 55
1983-84	271	OMU 216, EEI 55
1984-85	260	OMU 205, EEI 55
1985-86	250	OMU 195, EEI 55
1986-87	240	OMU 185, EEI 55
1987-88	229	OMU 174, EEI 55
1988-89	218	OMU 163, EEI 55
1989-90	205	OMU 150, EEI 55
1990-91	192	OMU 137, EEI 55
1991-92	180	OMU 125, EEI 55
1992-93	166	OMU 111, EEI 55
1993-94	151	OMU 96, EEI 55

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*Sales are noted by - sign.

Source: Kentucky Utilities Company (1981).

substitution of electricity for oil in some areas. KU's expected load growth would then be increased. Currently, increases in heating oil usage are not expected for the same reasons, so that KU's winter peak load will not be affected.

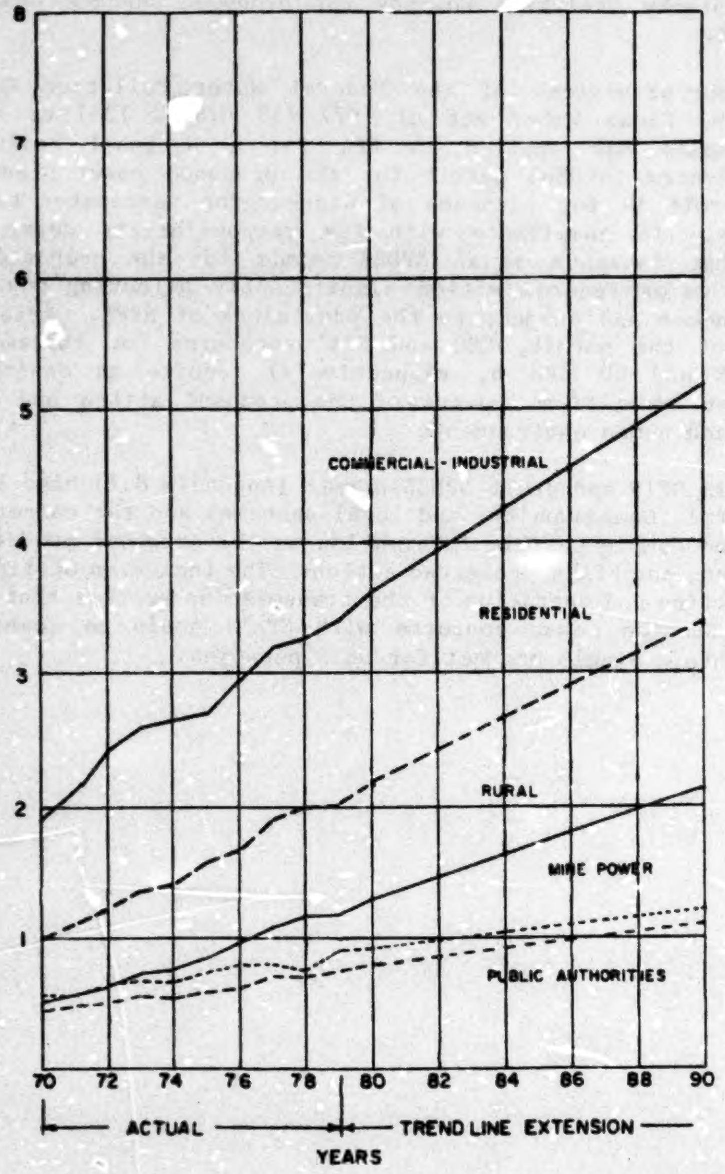
Solar power will not make a large contribution to energy requirements in KU's service area for years. At that, increased solar usage is expected to reduce only winter load until such time as technology can produce competitive electrical energy with solar power. Winter peak demand would not be affected noticeably by increased solar usage if the peak load period coincided with several consecutive cloudy days. Electrical energy consumption may be greater when solar power is used, as evidenced by two solar homes on KU's system. The two homes, which differ in size and possibly represent two diverse lifestyles, used 12,520 and 25,542 kWh, respectively, in 1980. By comparison, KU's average residential customer used 10,692 kWh and the average all-electric residential customer used 19,260 kWh in 1980.

1.2.6 Future Trends

The Applicant's current load forecast is a downward revision from the previous one. Development in KU's service area has slowed. It is expected to begin recovery in 1981, so that KU's growth rate will continue, but at a slower rate than that of the 1970s. KU expects to add about the same amount of MW load to its system during the nine years between 1980 and 1989 as it did in the six years from 1974 to 1980. This anticipates growth above the national average because of industrial expansion, increased electricity use for air conditioning and heating, and expansion of coal mining production.

Despite the effects of conservation, inflation, and recession in 1979, residential sales showed an annual growth rate of 6.9% from 1970 to 1979, and industrial and commercial sales showed an increase at an annual rate of 6.0% for the same period (Figure 1.2-5). Rural sales showed an even higher growth rate of 9.0% for the period. Mine power showed a growth rate of 4.6%, and if the relative percentage of underground mining increases, this will accelerate. An increase in underground mining would increase residential and commercial load because it is more labor intensive than strip mining.

Another factor that could have a large impact on KU's mining segment is synthetic fuel development. Kentucky's western coal fields have been experiencing slack demand for their product because of its high sulfur content. Should all or a substantial part of the proposed synthetic fuel plants (which are outside KU's service area) materialize in western Kentucky, the western Kentucky coal-mining counties that KU serves will experience substantial growth. Such a development will accentuate KU's need for additional capacity.



SOURCE: Kentucky Utilities (1981)

Figure 1.2-5. Kentucky Utilities Electrical Usage by Customer Class

1.3 NEED FOR ACTION

The action as defined for this document is EPA's issuance of an NPDES permit to Kentucky Utilities Company for proposed Hancock Generating Station Units 1 and 2.

Under provisions of the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.), Kentucky Utilities Company has applied to EPA for a National Pollutant Discharge Elimination System (NPDES) permit for the proposed power plant construction. The NPDES permit is for purposes of discharging wastewater to waters of the United States. In compliance with its responsibility under NEPA, EPA has determined that issuance of an NPDES permit for the proposed project would constitute a major Federal action significantly affecting the quality of the human environment and subject to the provisions of NEPA. Prior to a decision on issuance of the permit, CEQ and EPA procedures for implementing NEPA (40 CFR 1500-1508 and 40 CFR 6, respectively) require an environmental impact statement that identifies impacts of the proposed action and alternatives on the natural and human environments.

This DEIS and draft NPDES permit (Appendix 8.1) have been prepared to provide Federal, Commonwealth, and local agencies and the concerned public with sufficient and comprehensible information on the proposed project, alternatives to the project, and EPA's preferred action. The inclusion of impacts associated with construction and operation of the transmission systems that will distribute the Hancock Station power conforms with EPA's goals to combine all related activities into a single project for DEIS purposes.

2.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

KU's proposed development plan for the Hancock project was selected from a number of possible site locations and plant ancillary facilities designs and operations. Factors considered during the various selection processes included engineering, environmental, socioeconomic, and regulatory requirements, and costs of development.

This section also addresses alternatives considered by the Applicant during development of the proposed action as well as alternatives available to Federal and Commonwealth permitting authorities.

2.1 ALTERNATIVES CONSIDERED BY THE APPLICANT

Decisions resulting in KU's proposed action basically fell into four categories: whether to build the generating station, where to site it, how to fuel it, and which operational systems to use. Because detailed rationale for the build alternative was presented in KU's statement of the need for additional power in its service area (Section 1.2), relatively little discussion in this section is centered on management alternatives. Overall, for purposes of the EIS process, the most in-depth analysis of the other alternatives focused on KU's siting study and the ultimate selection of the Hancock and Breckinridge sites as potential locations for the generating station. Thus, an evaluation of KU's siting study is included in this section, and detailed treatment of the proposed project on each of the two sites occurs throughout the DEIS. The sites are located near each other on the Ohio River in western Kentucky (Figure 2.1-1).

2.1.1 Management Alternatives

2.1.1.1 Build the Generating Station

Kentucky Utilities proposes to meet forecasted demands by constructing and operating two 650-MW coal-fired steam electric generating units on the Hancock site near Ohio River Mile 715 in Hancock County, Kentucky (Figure 2.1-2). The Ohio River is proposed as the cooling water source, and coal delivery is planned to be by barge. Proposed waste disposal will utilize about two-thirds of the site area.

Transmission facilities proposed for Hancock Generating Station Unit 1 will consist of a 345-kV substation at the plant and a 10-mile double-circuit transmission line from the Hancock substation to an existing tie-in point about 1.5 miles southwest of Victoria Crossroads in southern Hancock County (Figure 2.1-3). Unit 2 transmission facilities will parallel the Unit 1 lines southward for 5 miles and continue eastward, paralleling an existing line, to a substation in southwest Elizabethtown in Hardin County, Kentucky. Site preparation is proposed to begin in 1982, with completion of Unit 1 and its transmission system in 1989 and completion of Unit 2 and its transmission system in 1994 (Figure 2.1-4). KU orginally planned Unit 1 operation for winter 1984/85 and Unit 2 operation for winter 1986/87, based on load growth rates of about 8%. The proposed dates reflect an estimated 3.4% load growth through 1994.

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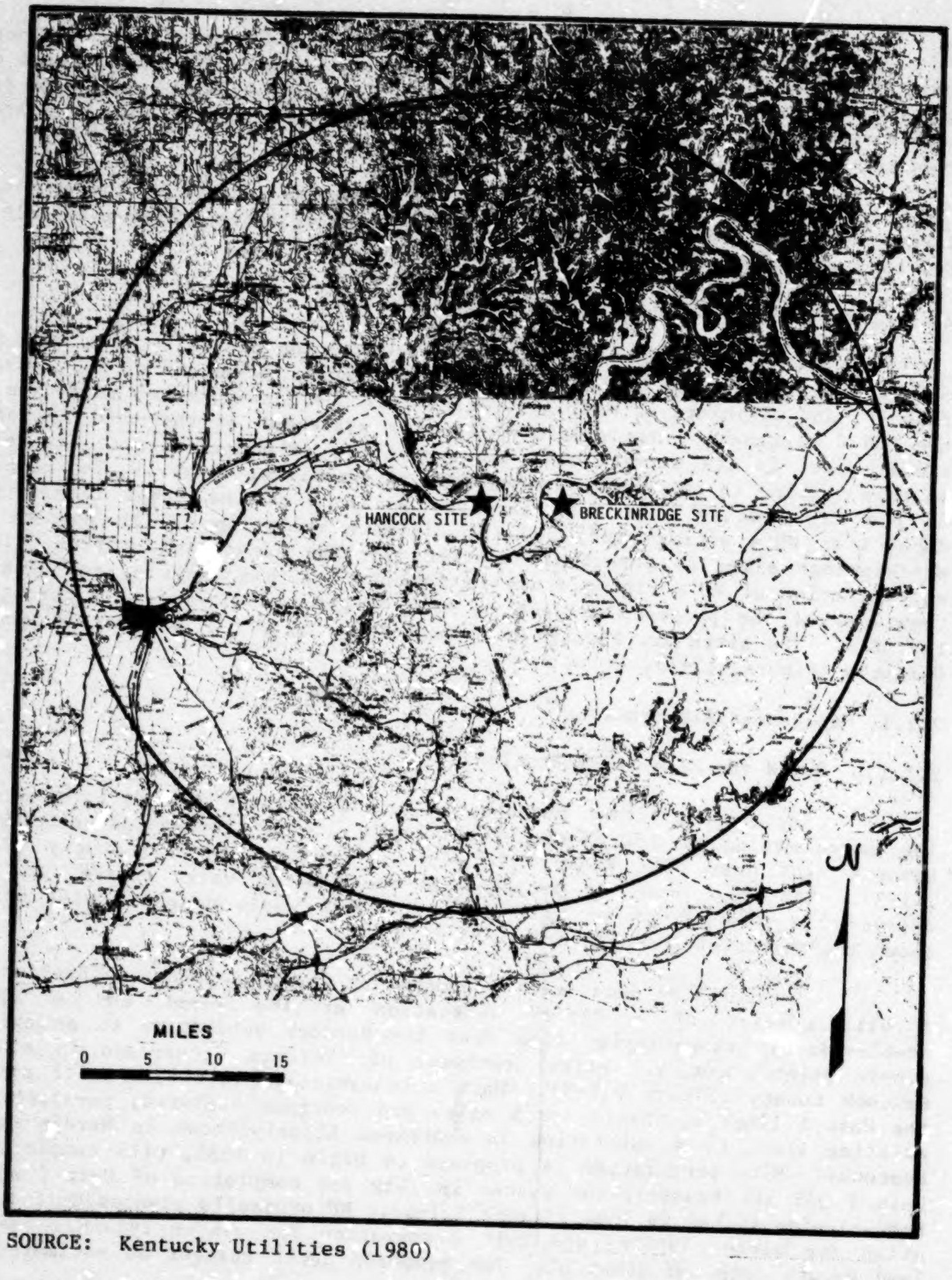
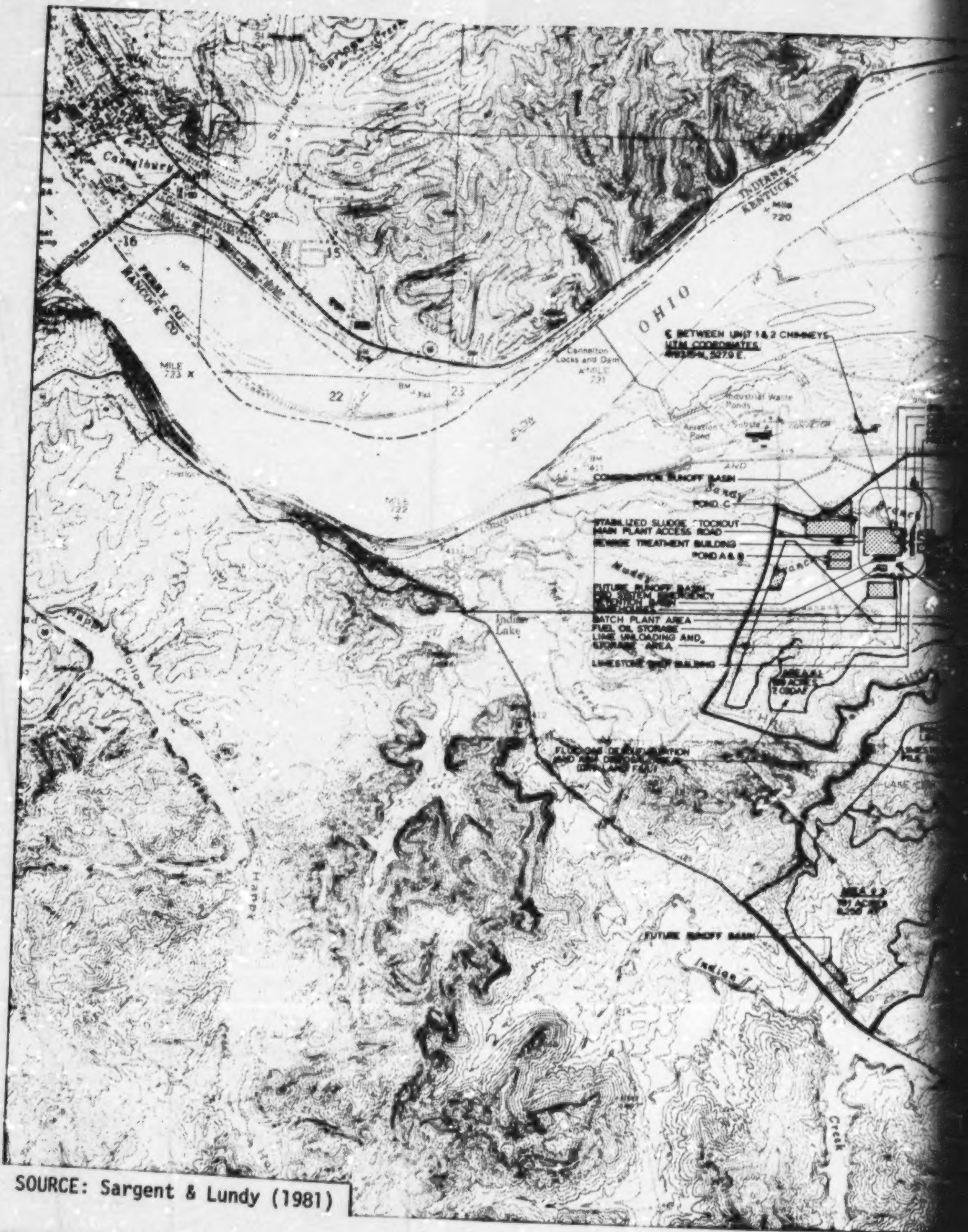

HANCOCK SITE
BRECKINRIDGE SITE
MILES
0
5
10
15
N

SOURCE: Kentucky Utilities (1980)

Figure 2.1-1. Locations of the Hancock and Breckinridge Sites


Cannelburg
PERRY CO.
HANCOCK CO.
INDIANA
KENTUCKY
Mile 720
OHIO
Cannelton Locks and Dam
MILE 721
MILE 723
MILE 722
22
23
15
16
LOUISVILLE
℄ BETWEEN UNIT 1 & 2 CHIMNEYS
UTM COORDINATES
Industrial Waste Ponds
Aeration Pond
Substa
CONSTRUCTION RUNOFF BASIN
POND C
STABILIZED SLUDGE STOCKOUT
MAIN PLANT ACCESS ROAD
SEWAGE TREATMENT BUILDING
POND A & B
FUTURE RUNOFF BASIN
BATCH PLANT AREA
FUEL OIL STORAGE
LIME UNLOADING AND STORAGE AREA
LIMESTONE PREP BUILDING
Indian Lake
Muddy
FUTURE RUNOFF BASIN
Indian
Creek
Happy Hollow
LAKE

SOURCE: Sargent & Lundy (1981)

Figure

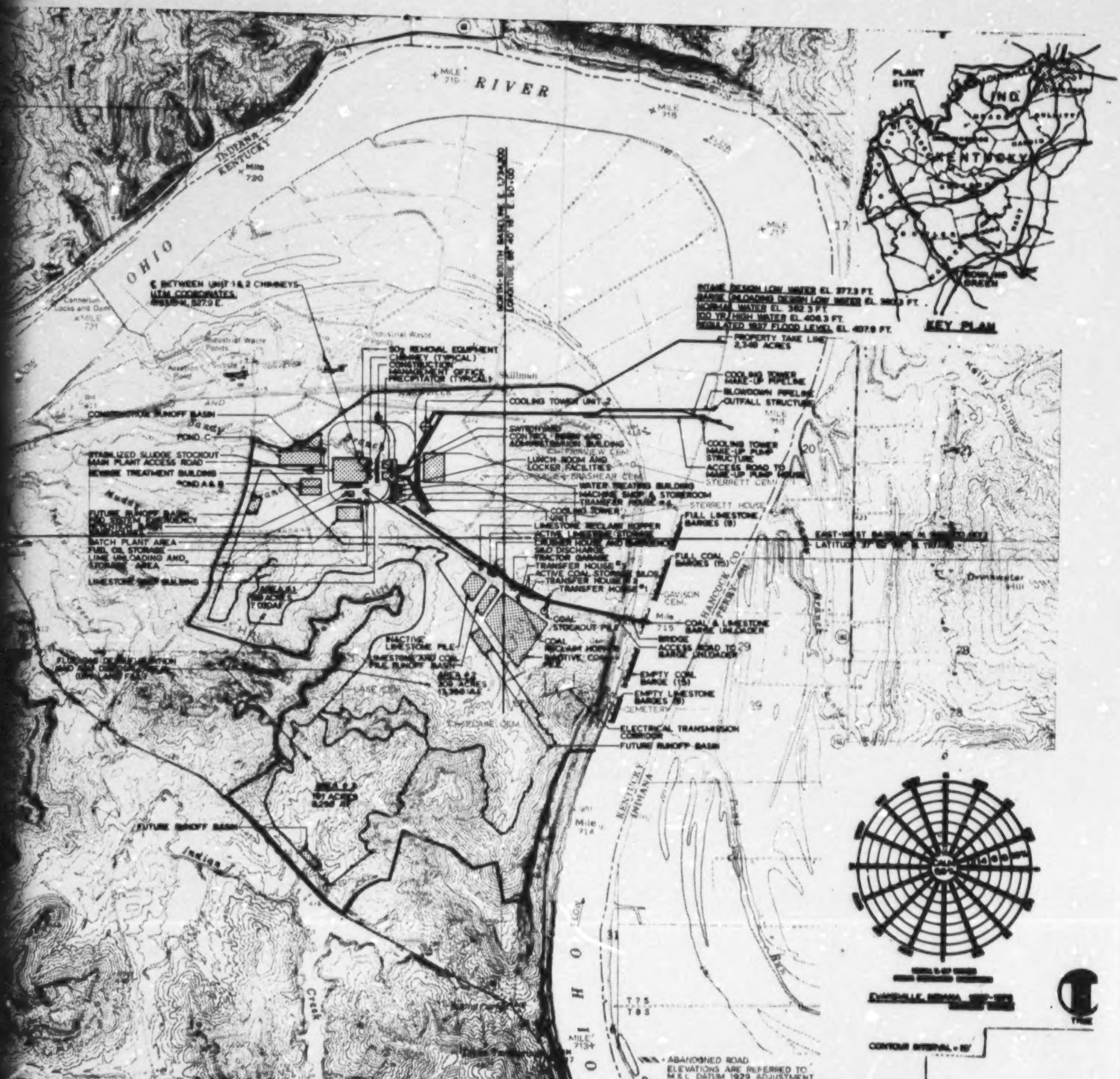
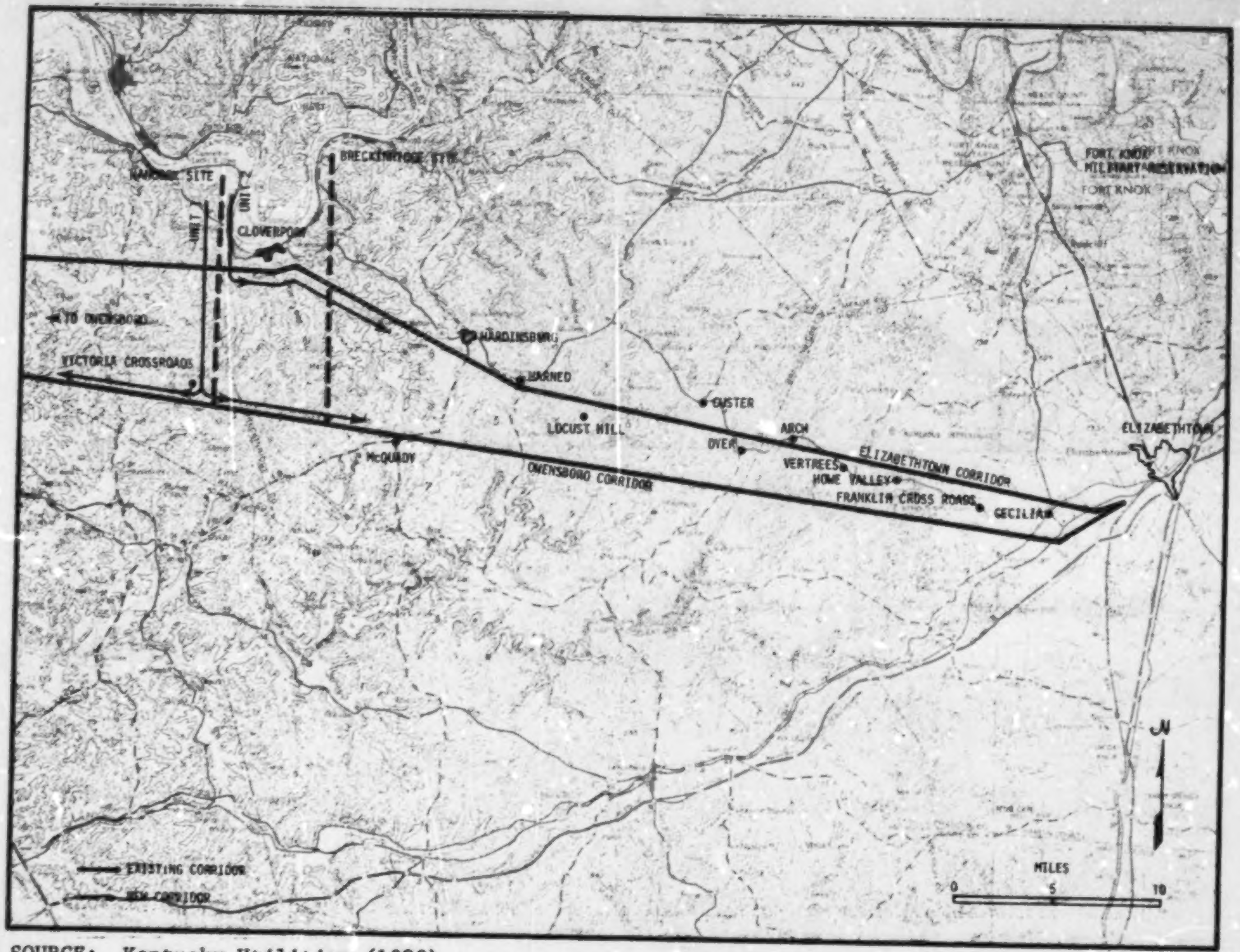
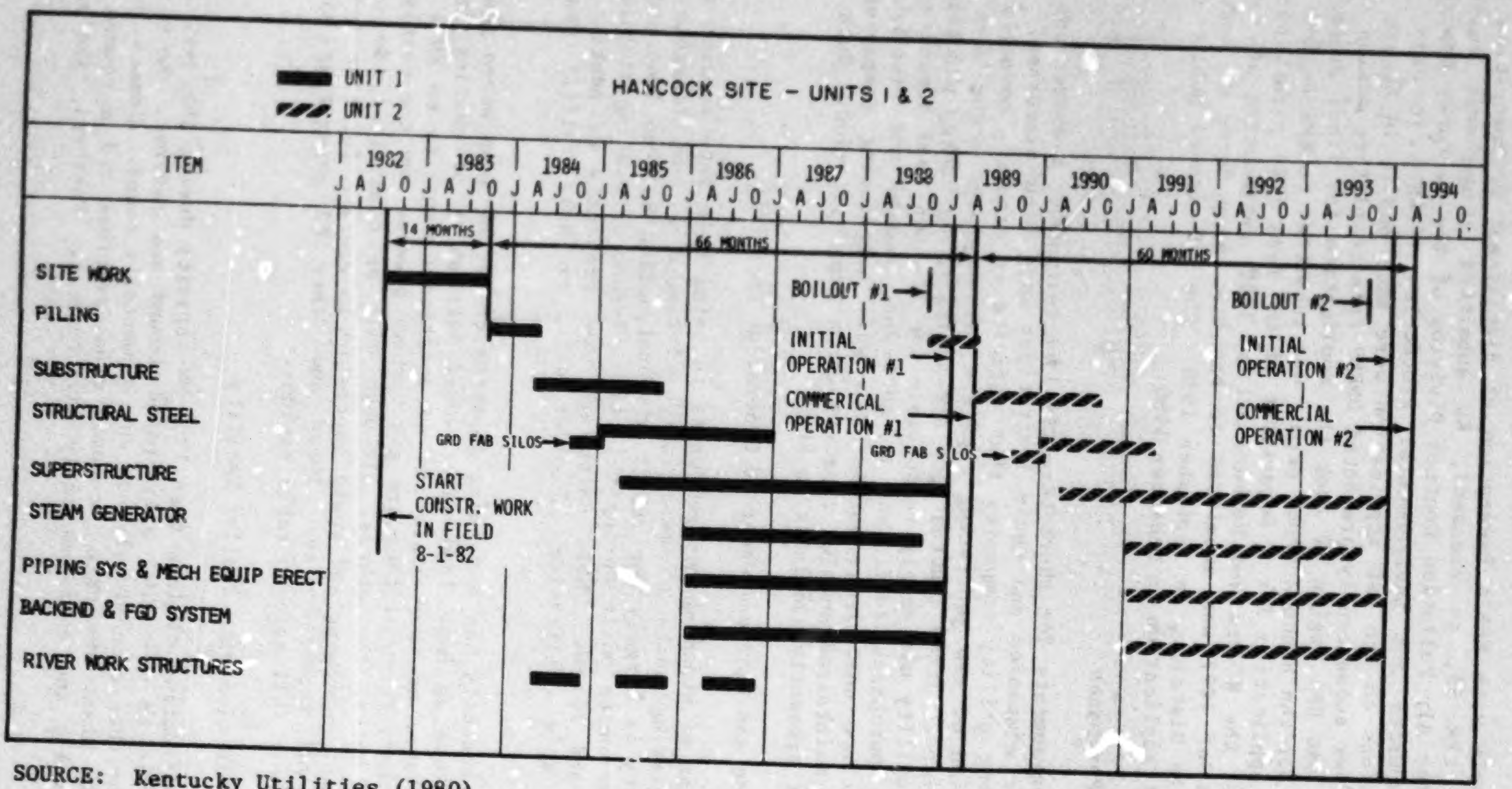

OHIO RIVER
MILE 719
MILE 718
MILE 717
MILE 720
MILE 721
INDIANA
KENTUCKY
Cannelton Locks and Dam
Industrial Waste Ponds
Skillman
KEY PLAN
PLANT SITE
IND.
KENTUCKY
℄ BETWEEN UNIT 1 & 2 CHIMNEYS
UTM COORDINATES:
SO2 REMOVAL EQUIPMENT
CHIMNEY (TYPICAL)
CONSTRUCTION MANAGEMENT OFFICE
PRECIPITATOR (TYPICAL)
COOLING TOWER UNIT 2
CONSTRUCTION RUNOFF BASIN
POND C
STABILIZED SLUDGE STOCKOUT
MAIN PLANT ACCESS ROAD
SEWAGE TREATMENT BUILDING
POND A & B
FUTURE RUNOFF BASIN
BATCH PLANT AREA
FUEL OIL STORAGE
LIME UNLOADING AND STORAGE AREA
LIMESTONE PREP BUILDING
INACTIVE LIMESTONE PILE
LIMESTONE AND COAL PILE RUNOFF BASIN
AREA 4.2
SWITCHYARD
CONTROL ROOM AND ADMINISTRATION BUILDING
LUNCH ROOM AND LOCKER FACILITIES
WATER TREATING BUILDING
MACHINE SHOP & STOREROOM
TRANSFER HOUSE #4
COOLING TOWER UNIT 1
LIMESTONE RECLAIM HOPPER
ACTIVE LIMESTONE STORAGE
CRUSHER HOUSE AND SAMPLING
S&D DISCHARGE
TRACTOR GARAGE
TRANSFER HOUSE #3
ACTIVE COAL STORAGE SILOS
TRANSFER HOUSE #2
TRANSFER HOUSE #1
COAL STOCKOUT PILE
COAL RECLAIM HOPPER
INACTIVE COAL PILE
INTAKE DESIGN LOW WATER EL. 377.3 FT.
BARGE UNLOADING DESIGN LOW WATER EL. 380.0 FT.
NORMAL WATER EL. 382.3 FT.
100 YR. HIGH WATER EL. 406.3 FT.
SIMULATED 1937 FLOOD LEVEL EL. 407.9 FT.
PROPERTY TAKE LINE 2,340 ACRES
COOLING TOWER MAKE-UP PIPELINE
BLOWDOWN PIPELINE
OUTFALL STRUCTURE
COOLING TOWER MAKE-UP PUMP STRUCTURE
ACCESS ROAD TO MAKE-UP PUMP HOUSE
STERRETT CEM.
STERRETT HOUSE
FAIRVIEW CEM.
BRASHEAR CEM.
GAVISON CEM.
FULL LIMESTONE BARGES (9)
FULL COAL BARGES (15)
EAST-WEST BASELINE
LATITUDE
COAL & LIMESTONE BARGE UNLOADER
BRIDGE
ACCESS ROAD TO BARGE UNLOADER
EMPTY COAL BARGE (15)
EMPTY LIMESTONE BARGES (9)
CEMETERY
ELECTRICAL TRANSMISSION CORRIDOR
FUTURE RUNOFF BASIN
HANCOCK CO.
PERRY CO.
KENTUCKY
INDIANA
Mile 715
Mile 714
Mile 713½
OHIO
Indian Creek
Drinkwater Hill
Kelly Hollow
EVANSVILLE, INDIANA
CONTOUR INTERVAL = 20'
ABANDONED ROAD
ELEVATIONS ARE REFERRED TO M.S.L. DATUM 1929 ADJUSTMENT

Figure 2.1-2. Proposed Hancock Site Layout


SITE
UNIT 1
UNIT 2
CLOVERPORT
BRECKINRIDGE STA.
FORT KNOX
MILITARY RESERVATION
FORT KNOX
TO OWENSBORO
VICTORIA CROSSROADS
HARDINSBURG
HARNED
CUSTER
LOCUST HILL
ARCH
DYER
ELIZABETHTOWN
ELIZABETHTOWN CORRIDOR
VERTREES
HOWE VALLEY
FRANKLIN CROSS ROADS
CECILIAN
McQUADY
OWENSBORO CORRIDOR
N
MILES
0
5
10
EXISTING CORRIDOR
NEW CORRIDOR

SOURCE: Kentucky Utilities (1980)

Figure 2.1-3. Location of Transmission Systems Associated with the Hancock Generating Station



SOURCE: Kentucky Utilities (1980)

Figure 2.1-4. Construction Schedule for Hancock Generating Station Units 1 and 2

To comply with EPA's Prevention of Significant Deterioration (PSD) Regulations (40 CFR 52, as amended), KU submitted atmospheric emissions predictions to the Air Pollution Control Division of the Kentucky Department for Natural Resources and Environmental Protection (DNREP) in July 1978. DNREP determinations on the PSD application were made public in August 1979. A restraining order subsequently prevented DNREP from completing action on the PSD application and EPA Region IV took the application for final processing. The application for the Hancock NPDES permit was submitted to EPA Region IV in May 1980. The application for a Department of the Army (DA) permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1977 was submitted to the U.S. Army Corps of Engineers (COE), Louisville District, in September 1980. The COE issued public notice of the DA permit application in December 1980.

2.1.1.2 Power Purchases

The agreements for short-term and long-term power transactions among KU and 11 other companies and their limitations have been discussed. It is commonplace among utility companies that deficits in capacity normally occur prior to addition of new generating capacity and surpluses occur when a new unit comes on line. These fluctuations are minimized by energy purchases and sales, with a utility ultimately responsible for its own load demand and reserve. Energy purchases sufficient to meet load demand and preclude construction of a new unit are possible only when neighboring companies have over-built and maintained surplus capacity for a lengthy period. Such excess capacity is not presently available to KU.

2.1.1.3 Upgrade and Baseload Other KU Generating Facilities

KU has no standing retired units to bring back into service and upgrading of existing units to meet increased demand is not feasible. KU's present capacity is largely the result of construction between 1946 and 1977. The first three units built during this time (Tyrone Generating Station) produce 32, 32, and 76 MW. These units are used presently as peaking units, demonstrating KU's utilization of older units to help fulfill peak load demands.

KU presently has a peaking capacity of 321 MW from seven generating units. Their use as base load units would fall short of meeting increased load requirements, as they would add no additional capacity to KU's reserve margins. Further, three of them are gas turbine powered and too costly to run as base load units; the others, although oil- or coal-fired, do not have modern efficient equipment and would be costly to operate for base load, both economically and resource-wise. These and other KU generating units are utilized to their full safe operable ratings.

2.1.1.4 Construction of a Smaller Facility

Construction of less than 1300-MW capacity during the next 13 years is not feasible to meet KU's anticipated demand and reserve. More than one facility is neither economically nor environmentally sound. Common components of a two-unit plant are prime economic considerations and a common site is both economically and environmentally advantageous. Further, time necessary to gain permits for the number of smaller facilities required to meet KU's estimates would push completion of the facilities beyond 1989.

2.1.1.5 Curtailment and Conservation

Present energy policy does not advocate curtailment of electrical power to customers as a means of conserving energy. Kentucky Utilities does not have any contractual interruptible loads, although its two largest industrial customers can be asked to curtail their operations during peak loads or suffer rate penalties for the next 12 and 6 months, respectively for each violation. Each of these industries has approximately 20 to 25 MW demand, and curtailments generally total 15 MW to 20 MW. This small depression in load demand is included in future estimates.

The effects of conservation also are included in future estimates as part of KU's slowed growth characteristics. Conservation efforts continue at KU, with both residential and commercial service advisors available and active. Programs conducted during 1979 included consultations with home builders and commercial construction firms; 66 weatherization workshops to demonstrate caulking, insulation, and weatherstripping techniques; and nearly 2000 presentations on energy conservation, energy supply, and electricial safety. Customer education in energy conservation also includes bulletins enclosed with monthly bills and short, occasional TV spots. Rate advantages are offered for home water heating units that are designed to operate during off-peak periods.

During 1979, KU began preparing for implementation of the Residential Conservation Service Program, as specified by the National Energy Conservation Act of 1979. Although the proposed program covers only residential customers, KU has trained commercial service advisors to conduct walk through energy audits designed to show commercial and institutional customers how to implement low cost procedures to improve energy efficiency.

The National Energy Plan concentrates on conservation of oil and natural gas. Parts of the energy plan have the potential for directly conserving electrical energy: reduction of energy waste in buildings, mandatory appliance efficiency standards, industrial conservation and fuel efficiency improvements, and utility reform. Conservation practices that have been incorporated into policies in other regions of the United States are presented below. These measures either are or will become cost effective with significant future increases in the real price of electricity.

Residential Sector

1. Retrofitting. Insulation, weatherstripping and caulking, and storm windows can achieve savings of up to 20% of home energy use.

2. Heat-Conserving Construction in New Residences. An estimated energy savings of 30% in new homes built after 1980 could be achieved, using ASHRAE 90-75 standards.

3. Improved Appliance Efficiency. Major energy-using appliances include water heaters, kitchen ranges and ovens, clothes dryers,

refrigerators, freezers, and television sets. Federal Energy Administration target levels for increased efficiency range from 10% for water heaters to as much as 80% for television. Estimated savings by improving the energy efficiency of all these major appliances is 43%.

Commercial Sector

1. Reduction in Lighting (Levels and Quantity). Using task lighting and reducing lighting levels in general can yield considerable savings. The National Bureau of Standards suggests that reductions of 15% of lighting energy in existing buildings and 25% in new buildings are possible. Two other reports estimated that reduced lighting levels could save up to 90% of electricity used for lighting. The Northwest Policy Project estimated that 50% savings of lighting demand can be achieved (15% of the commercial sector use).

2. Reduction in Infiltration and Ventilation (Existing Buildings). Ventilation rates commonly used for large office buildings could be greatly reduced without incurring lowered air quality. Assuming ventilation rates of 25 cubic feet per minute, the Energy 1990 study indicated that energy requirements for space heating could be reduced by 50% if there were a reduction of 5 cfm to 10 cfm. The Northwest Policy Project (NEPP) estimated that reductions in infiltration and ventilation can achieve savings of 5 to 8% of the total commercial sector energy demand.

3. Retrofitting of Existing Buildings. Retrofitting measures could reduce a commercial sector energy use by 23%, according to the NEPP study; this includes limited wall insulation, roof insulation, double-glazed windows, and ground-floor carpeting.

4. Design New Buildings for Energy Conservation. ASHRAE has developed a model building code that sets performance standards for efficient design (ASHRAE 90-75). Buildings designed to these standards are intended to have high thermal resistance and low air leakage and to use improved mechanical and electrical systems that promote the efficient use of energy. NEPP's estimated savings for this measure is 39% of the commercial sector's energy use. There are additional measures that could be incorporated to increase energy-use efficiency, including the removal of waste heat from lighting by changed air circulation, use of tinted glass, reduced window area, and lower ceiling heights in retail stores.

Industrial Sector

1. Industrial Housekeeping. Numerous studies have indicated that industrial conservation could yield from 15 to 30% energy savings. As indicated in several reports, it is difficult to analyze this sector and to specifically quantify the potential

savings. The recommended conservation measures are minimal and do not include industrial processes.

2. Recycling. Although not applicable to all service areas, those that have aluminum industry or other industry able to recycle can achieve savings. An estimated 18% of energy consumed by the aluminum industry could be saved through implementation of recycling programs.

2.1.2 Alternative Energy Sources

In evaluating energy alternatives, KU determined that the energy source most likely to be a realistic alternative to coal, considering availability, state-of-the-art, and economics, was nuclear fission. Other sources included in the evaluation were oil, gas, municipal refuse, geothermal energy, solar energy, wind and hydropower.

2.1.2.1 Coal

Coal proposed for the Hancock Plant will come from western Kentucky, southern Illinois, and southern Indiana, which comprise the Eastern Interior Coal Region (Energy Research and Development Administration 1977). Strip mining is more prevalent (70%) than underground mining in this region, resulting in extensive, long-term impacts to natural and managed terrestrial ecosystems. Although recovery time of the strip-mined land depends on several factors, average estimates for restoration of pasture and crop productivity are 30 years after mining, providing acid drainage and toxic substances are properly treated (ERDA 1977). Forests begin to develop within 20 years, with restoration of a mature hardwood forest probably occurring 150 to 200 years later. Wetlands and bottomland forests (probably the most productive ecosystems in the region) are difficult to impossible to restore. Mining impacts to water quantity in this region are minimal, but acid mine drainage could create chronic water quality problems.

Coal handling, preparation, and transportation, despite suppressant procedures, impact particulate levels in local areas (ERDA 1977). Overall socioeconomic impacts associated with mining and coal handling in this region are projected to be generally small compared with other coal regions owing to a moderate to ample infrastructure and flourishing economy. The U.S. Department of Energy (formerly ERDA) expects mining and its impacts to continue in this region at the same or an accelerated pace. In-situ coal conversion, which should mitigate some of the impacts, is an incompletely developed technology that currently is receiving less Federal research money than other coal conversion programs.

DOE analysis of Eastern Interior Region coal (ERDA 1977) is similar to that presented by the Applicant: 9,700 to 12,700 Btu/lb heat content, 1 to 5% sulfur content, and 7 to 13% ash content. The Applicant's representative coal analysis showed a sulfur content of 3.5% and an ash content of 14.5%. Representative coal and coal ash analyses were:

COAL	
Heating Value	10,500 Btu
Fixed Carbon	41.00%
Volatile Matter	29.00%
Moisture	12.00%
Ash	14.50%
Sulfur	3.50%
Pyritic	2.00%
Sulfate	0.04%
Organic	1.46%

COAL ASH	
Silica (SiO_3)	46.82%
Ferric Oxide (Fe_2O_3)	21.48%
Alumina (Al_2O_3)	20.90%
Titania (TiO_2)	0.97%
Calcium Oxide (CaO)	3.15%
Magnesium Oxide (MgO)	1.14%
Sulfur Trioxide (SO_3)	2.26%
Potassium Oxide (K_2O)	2.08%
Sodium Oxide (Na_2O)	0.37%
Phosphorous Pentoxide (P_2O_3)	0.24%

Among other reasons, coal was chosen over nuclear fuel because the minimum capacity nuclear unit that is economically worthwhile for electric utilities to construct is 1000 MW and above. KU's present system would be severely stressed when outage or maintenance of a 1000 MW unit occurred, so smaller, coal-fired units were chosen to maintain system reliability without purchasing additional capacity. Further, coal is readily available in the region and long-term costs probably will be no greater than nuclear fuel (discussed below). Environmental impacts of coal production (especially) and use may be overall greater than those of nuclear fuel, although several effects of nuclear fuel use remain unknown (Table 2.1-1), and the public safety is an overriding concern.

2.1.2.2 Nuclear Fission

Uranium is obtained from relatively isolated and ecologically fragile semidesert areas where both open pit (60+%) and underground mining occurs (ERDA 1977; DOI 1977). Environmental effects of uranium mining and refining include removal of vegetation, disposal of overburden and waste-rock, disposal of low-level radioactive tailings that are unusable and must be retained in carefully constructed tailings dams, and release of airborne radionuclides (primarily radon gas and daughter products). Chemical effluents, gaseous and particulate emissions, heat, radioactive isotyopes of uranium, and radioactive fission products are released during fuel enrichment, fabrication, and reprocessing. Heat and radionuclides are released during waste retrieval and temporary storage. Radionuclides are released during transportation of all uranium products. All radionuclide releases are strictly controlled and estimated doses are well below natural background levels. Ultimately, wastes are buried in engineered storage facilities that deter radionuclide release to the surface.

Physical constraints are somewhat different for nuclear plants than for coal-fired units and perhaps less restrictive. Although rail facilities are used occasionally for transporting nuclear fuel, truck transport is more common, eliminating the need for nearby rail or navigable waterways, as in the case of coal. Both types of generation need a substantial water supply (Table 2.1-1). However, cooling water demands of nuclear plants are greater than those of coal-fired units because nuclear plants have a lower thermal efficiency and release no waste heat to the atmosphere (water requirements for

Table 2.1-1. Comparison of Environmental Effects of Nuclear and Coal-Fired Power Plants (1000 MW)*

Power	Air Quality	Water Quality		Water Quantity	Solid Waste	Land Use	Biological	Human Health
		Surface Water	Groundwater					
Nuclear	Radionuclides (maximum dose = 0.012 mrem/yr at 1000 m) Cooling tower drift (varies; precipitates as much as 80 lb salts/acre/yr within 0.5 mi of mechanical draft tower)	Heat Chemicals applied to uptake water Deposition of air emissions Radionuclides in effluents (maximum dose = 0.001 mrem/yr	Leachates from deposits	Consumes 30 cfs of 1250 cfs intake water	High-level radioactive material (80-100 ft^3/yr)	500 acres; if cooling ponds used, additional 1500 acres/1000 MW	Chronic effects of low-level radioactivity unknown Modification and loss of natural habitat Entrainment Impact of heat effects depends on water body's ability to disperse 15-20°F temperature rise; varies from modest in large rivers and lakes to significant in smaller ones	Same as Biological Poses some risks of accidents
Coal-fired	Particulates (3.5 thousand tons/yr) Trace elements Sulfur dioxide (41.4 thousand tons/yr) Nitrogen oxides (24 thousand tons/yr) Cooling tower drift (same as nuclear)	Leachates from coal and waste storage Deposition of air emissions	Same as surface water Leachates from deposits	No discharge plants consume all (22 cfs) intake water; others consume approximately half of intake	Ash (430,000 tons/yr) Scrubber sludge	550 acres; if surge pond used, additional 150 acres/1000 MW	Impact of chronic effects of low-level toxic substance exposure largely unknown Acute exposure to SO_2 can damage plants Modification and loss of natural habitat Entrainment Impact of heat effects depends on water body's ability to disperse 10°F temperature rise	Same as Biological Acute exposure aggravates respiratory problems and irritates eyes

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*Quantities and radiation exposures are estimates from generic studies.

Sources: U.S. Department of Interior (1977); Energy Research and Development Administration (1977).

typical 1000-MW coal-fired and nuclear plants are around 22 cfs and 30 cfs, respectively). Geologically stable terrain is a major requirement for a nuclear plant as is distance from population centers. Coal-fired plants also require geologic stability and are further limited to locations in air quality attainment areas. Emissions of combustion gases are not relevant to nuclear plants.

Impacts associated with construction of the two types of plants are essentially the same. Air quality is affected for the short term by an increase in suspended particulate matter from dust and exhaust emissions. Erosion and siltation likely will occur during excessive rainfall. Socioeconomic impacts are large, peaking around the middle of the construction phase in conjunction with the greatest labor force. The influx of a comparatively large population for a short period of time generally creates a set of problems associated with municipal, social, and emergency services; social structure; employment; and business and housing development.

For comparing operational impacts, little is known about chronic effects associated with low-level exposures of biota and man to toxic substances from coal-fired plants and to radionuclides from nuclear plants (Table 2.1-1). The most salient differences in potential environmental impacts are those associated with the greater extent of land use and terrestrial/wetlands habitats committed to cooling ponds for some nuclear plants and the thermal discharge of others.

Public concern about the safety of nuclear fuels handling and use remains the foremost issue in continued development of nuclear power. Legal difficulties arising from this concern and escalating costs and delays in equipment deliveries are deterrents to the utility industry. Further, the normal lead time for putting a nuclear plant on line has increased significantly since the Three Mile Island incident and moratorium on licensing new plants.

Costs of nuclear fuel processing, the generating units, and certain support functions in the fuel cycle have increased at a greater rate than those of comparable fossil-fuel facilities and functions (U.S. Geological Survey 1977). Fuel costs, although lower at present, are not expected to remain significantly so. Thus, the economic benefit that generally has been realized beyond the initial construction costs of several large-unit nuclear plants likely will diminish in the near future; new plants may realize none prior to widespread use of breeder reactors. The world price of uranium has doubled in the past few years and it is expected to rise in response to short supplies of known reserves relative to increased demands.

2.1.2.3 Oil and Gas

The Power Plant and Industrial Fuel Use Act of 1978 (PL 95-620) prohibits the use of natural gas or petroleum as a primary energy source in new electric power plants. KU's proposed use of fuel oil for an auxiliary boiler in the power plant (see Subsection 2.1.4.1) is within Federal Energy Regulatory Commission rules pursuant to this Act.

2.1.2.4 Other Energy Sources

Of the additional energy sources considered for power generation, only municipal refuse appeared to be a viable supplement to coal or nuclear fuel and none was a suitable alternative energy source for generating the entire 1300 MW for KU's projected energy needs (Table 2.1-2). Costs were the primary factor in rejecting use of municipal refuse as a coal supplement. Excessive costs would accrue either from building several small generating units for local refuse use or from transport of prepared fuel to larger units. Preparation of refuse for fuel use currently is more expensive than coal or nuclear fuel preparation, although these costs generally are shared by municipal governments involved. Dual purpose boilers for firing coal and refuse would be required.

2.1.3 Alternative Sites

2.1.3.1 Site Selection

The Applicant's siting study searched for locations suitable for a 2- to 4-unit (500 to 600 MW each) fossil-fuel generating station, a 2-unit (1000 to 1200 MW each) nuclear station, or both. The study was conducted from March 1977 to mid-1978. Details of the study are in Section 2.1.3 of the Technical Appendix. In response to comments from reviewing agencies during the scoping portion of the EIS process, EPA required a review of the siting study and presentation of the study methodology and results of the evaluation in the DEIS. Both the siting study and the evaluation of site selection (also detailed in Section 2.1.3 of the Technical Appendix) are based on information pertinent at the time of the study. Thus, data displays and text do not reflect the extensive detail developed later for the Hancock and Breckinridge sites nor do they reflect changes in the status of sites (e.g., site G-1 is now occupied; boundaries of the Breckinridge site have been changed).

2.1.3.1.1 Siting Process

To select the Hancock, Breckinridge, and other alternate sites, the Applicant's consultant initially identified 63 potential site areas in Kentucky and 5 in western Virginia, primarily on the basis of cooling water availability, access to a railroad, and topography. After the initial identification of sites, an interdisciplinary team of engineers and environmental specialists reviewed topographic maps, technical data, and scientific literature to identify prohibitive factors that would eliminate any of the sites from further consideration. The engineering considerations included geological, seismological, and foundation design aspects. Environmental considerations included land use, demography, ecology, meteorology, and air quality.

Sites considered acceptable after the preliminary screening were identified on USGS 7.5 minute topographic maps and evaluated in greater detail for water supply. Preliminary and secondary screening eliminated 23 sites, including all 5 sites in Virginia.

The remaining 45 sites were grouped into those suitable for fossil-fueled plants, those suitable for nuclear plants, and those suitable for

Table 2.1-2 Comparison of Power Generation Alternatives Other Than Coal and Nuclear Fission

Energy Source	Viability	Advantages	Disadvantages
Geothermal Energy	Must be used near source; no proven source in Kentucky.	Not applicable	Not applicable
Wind	Questionable reliability of wind power in project area; requires 500 to 1000 generating units, 45 square miles of land, and winds of 7 to 9 meters per second to produce 1130 MW.	Not applicable	Not applicable
Hydropower	Limited availability in Kentucky; not sufficient for 1300 MW anywhere in the Commonwealth; most hydropower units in Kentucky are less than 50 MW.	Not applicable	Not applicable
Solar	1000 MW would require a collecting surface of 36 square miles if efficiency of conversion to electrical energy is 35%; most suitable for residential use to offset electrical energy used for water and space heaters.	Not applicable	Not applicable
Municipal Refuse	Widespread use where fuel costs are high (Europe, especially); most practical capacity is 200 to 400 MW with maximum of 500 MW; most suitable as supplement to coal if obtainable nearby; Kentucky Utilities' largest municipality (Lexington) could produce maximum of 25 MW at 5000 Btu/lb; U.S. supply could produce 10 to 15% of total boiler heat load.	Reduces solid waste problem; saves other fuels; decreased air pollutant emissions and solid waste generation; acceptable disposal of solid wastes.	In U.S., cost of preparation and transport remains higher than that associated with fossil or nuclear fuels; utilization by Kentucky Utilities would require several small generating units spread throughout its service area.

Sources: Jackson (1974); Shannon (1975); Bonneville Power Administration (1977); Sarofin (1977); U.S.Department of Interior (1977).

both. Sites were then evaluated in greater detail on the basis of eight considerations: site development, geology, hydrology, ecology, meteorology and air quality, existing and planned cultural resources, site access, and interferences with existing transportation facilities. Available literature, Commonwealth and Federal maps, and government agencies were among the information sources used at this stage of the site selection process. The agencies visited to discuss the possibility of obtaining water from existing reservoirs and major rivers, as well as the permit regulations applicable to the impoundment of streams, were COE, Louisville District; USGS, Louisville; and the Kentucky DNREP. Various reports and data pertaining to the water resources aspects of the study were also obtained from these agencies.

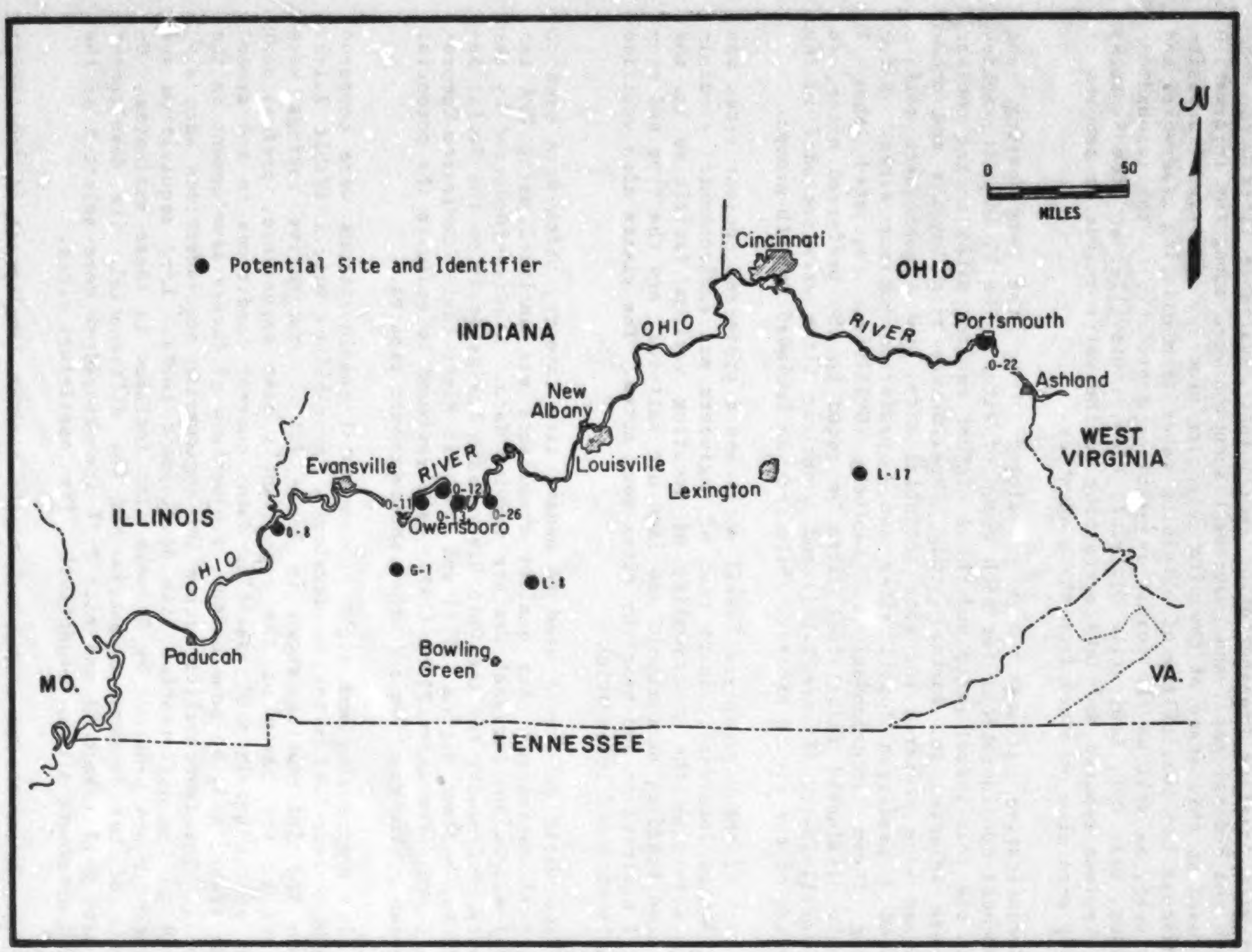
Quantitative indices were developed from the engineering and environmental considerations for each group of sites. The 11 highest ranking sites in the fossil-fuel group and the 7 highest ranking sites in the nuclear group were selected for further study. Preliminary site layouts and other evaluations were prepared for each potential site, and a subsequent ranking identified 7 preferred fossil sites and 6 preferred nuclear sites. After reviewing these recommendations, Kentucky Utilities requested that 2 previously eliminated fossil-fuel sites be added to the preferred sites, so that 9 fossil-fueled (Figure 2.1-5) and 6 nuclear sites were included in the final phase of the siting process. Site L-8 was included in both groups.

Each of the 9 preferred fossil sites and 6 preferred nuclear sites was visited by an interdisciplinary team of engineers and environmental specialists to determine the practicality of locating various facilities on the site. Road traffic, demographic and land use patterns, and the type and condition of habitats on and near the sites were noted. The visits also verified previously obtained information.

Site visit data were used to update site layouts, which were used to develop cost estimates. Air quality compliance was analyzed using EPA recommended models and National Weather Service data. Studies conducted by the University of Kentucky for the Ohio River Basin Energy Study on the Social Aspects of Power Plant Siting (1977) and the Ohio River basin Commission Comprehensive Coordinated Joint Plant (1978) were reviewed to evaluate the potential for adverse public reaction and other socioeconomic impacts.

Nine engineering and eight environmental considerations were compared among the fossil-fuel sites to develop a favorability matrix (Table 2.1-3) based on the information shown in Table 2.1-4. Subjective ratings were determined on the basis of the consultant's past experience, professional judgment of the totality of assembled data, current conditions in and around the site areas, and, to some extent, projections of future development in the site areas. The favorability ratios for engineering considerations were also reflected in the differential site development costs. Land acquisition and transmission costs provided by KU were also included in these estimates. On the basis of the comparison matrix and the differential site development costs, site 0-13 (Hancock) and site 0-26 (Breckinridge) were selected as the prime and alternate sites, respectively, for fossil-fuel sites.

Hancock was chosen as the prime site because development of four units of 550 MW capacity was possible on the basis of air quality considerations


Potential Site and Identifier
0
50
MILES
ILLINOIS
INDIANA
OHIO
WEST VIRGINIA
VA.
MO.
TENNESSEE
OHIO
RIVER
OHIO
OHIO
RIVER
Cincinnati
Portsmouth
0-22
Ashland
New Albany
Louisville
Lexington
L-17
Evansville
0-11
0-12
0-13
0-26
Owensboro
G-8
G-1
L-8
Paducah
Bowling Green

SOURCE: Kentucky Utilities Siting Study (1978)

Figure 2.1-5. Location of Kentucky Utilities Nine Preferred Fossil Fuel Sites

Table 2.1-3. Relative Favorability Comparison Matrix for Kentucky Utilities Preferred Fossil-Fuel Sites

	G-1	L-8	L-17	0-8	0-11	0-12	0-13*	0-22	0-26*
Engineering Consideration									
Water Supply	●	●	●	◉	◉	◉	◉	◉	◉
Foundation Considerations	x	●	●	x	x	x	x	x	x
Flood Hazards	●	◉	◉	●	x	●	●	●	●
Rail Access	●	●	x	●	◉	◉	◉	◉	◉
Highway Access	◉	●	x	●	●	●	●	◉	●
Seismic Risk	x	◉	◉	x	x	x	x	◉	x
Topography	●	●	x	x	●	●	●	●	●
Man-Made Interference	●	x	x	x	●	●	●	●	◉
Airports and Air Space	◉	●	●	x	●	x	●	●	●
Environmental Consideration									
Aquatic Ecology	◉	x	x	◉	●	◉	●	◉	●
Terrestrial Ecology	◉	x	x	◉	●	◉	x	●	x
Archaeological and Historical Sites	◉	◉	◉	◉	◉	●	◉	◉	x
Land Use	◉	x	x	●	●	◉	◉	●	◉
Socioeconomic Considerations	◉	●	x	◉	●	◉	◉	◉	●
Dispersion Characteristics	●	●	●	●	●	●	●	x	x
Air Quality Considerations	x	●	◉	x	●	●	◉	x	●
Potential Fogging and Icing	●	●	●	●	●	●	●	●	●

Favorability Code:

◉ = More Favorable

● = Favorable

x = Acceptable

---

*This matrix was formulated during the site selection study and does not reflect extensive detail developed later.

Source: Site Selection Study, Sargent & Lundy (1978).

Table 2.1-4. Summary of Salient Features of Kentucky Utilities Preferred Fossil-Fuel Sites (Sheet 1 of 4)*

		G-1	L-8	L-17	O-8	O-11
ENGINEERING CONSIDERATIONS	HYDROLOGY	Source of water - Green River controlled by U. S. Army Corps of Engineers' reservoirs upstream; can support four 550 MW units; site above 100-year flood level.	Source of water - cooling lake formed by daming Rough River upstream of existing Corps Reservoir; site above the flooding level; can support four 550 MW units.	Source of water - cooling lake formed by damming Slate Creek; site above the flooding level; possibly can support four 550 MW units.	Site partially in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.	Site in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.
	GEOTECHNICAL	Foundations - mats on alluvial soils or bedrock or controlled backfill.	Foundations - mats founded on residual soils or possibly bedrock.	Foundations - mats founded on residual soils or bedrock.	Deposits in the floodplain permeable; foundations - piles up to 124 ft deep; numerous active and abandoned oil wells present in the site vicinity; several abandoned coal mines and two active subsurface coal mines within 2 miles of the site.	Deposits in the floodplain permeable; foundations for plant structures - mats or piles 80 to 140 ft deep; oil wells present at site (Spencer 1964a).
	SITE DEVELOP-MENT	Flat to rolling topography; Louisville and Nashville (L&N) RR spur ~6 mi; combined ash and SO_2 storage[a] for 21 years for four units.	Flat topography; Ill. Central Gulf RR (ICG) spur ~2 mi; combined ash and SO_2 storage[a] for 20 years for four units.	Gently rolling topography; Chesapeake & Ohio (C&O) RR; spur ~9 mi; combined ash and SO_2 storage[a] for 11 years for four units.	Flat to rolling topography; ICG RR; spur ~5 mi, combined ash and SO_2 storage[a] for 40 years for four units.	Flat topography; L&N RR; spur ~1 mi; combined ash and SO_2 storage[a] for 22 years for four units.
	SPECIAL PROBLEMS	Permits from Corps for water supply needed; mineral development may affect construction if oil, gas wells & coal mines on site are active. Lining of ash and SO_2 ponds may be necessary. RR spur crosses creeks and highway; one state highway passes through site.	Permits from Corps needed; blowdown may affect existing reservoir used for recreation and water supply; investigations necessary for faulting in dam abutments.	Investigations needed in the dam abutments for faulting; bridges over the lake for RR spur; state route & several light duty roads would be rerouted; several pipelines cross the lake & site; several road bridges on the lake needed; lining of ash and SO_2 ponds may be necessary.	One state highway passes through the plant site and another passes through the ash and SO_2 sludge pond; lining of portions of these ponds may be necessary; reported mining activity in the site area and associated potential subsidence problems; site in Seismic Risk Zone 3.	Lining of ash and SO_2 ponds may be necessary; 8 ft of fill needed for plant grade; creek on site to be rerouted; ownership of mineral rights would need to be determined.

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[a] The on-site storage capacity is based on a maximum dike height of about 40 to 50 feet for perched ash and SO_2 sludge ponds and about 80 to 100 feet dam height for these ponds formed by damming a creek in the site vicinity.

[b] NSPS for SO_2 = 1.2 lbs/10^6 Btu
NSPS for TSP = 0.1 lbs/10^6 Btu

*This matrix was formulated during the site selection study and does not reflect the extensive detail developed later.

Source: Site Selection Study, Sargent & Lundy (1978).

Table 2.1-4. Summary of Salient Features of Kentucky Utilities Preferred Fossil-Fuel Sites (Sheet 2 of 4)

		O-12	O-13	C-22	O-26
ENGINEERING CONSIDERATIONS	HYDROLOGY	Site in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.	Site in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.	Site in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.	Site in Ohio River floodplain; source of water - Ohio River; can support four 550 MW units; site above 100-year flood level.
	GEOTECHNICAL	Deposits in floodplain permeable; foundations - mats and/or piles up to 100 ft. Numerous oil wells present at site (Spencer 1964B) may be inactive now.	Deposits in floodplain permeable; foundations - mats and/or piles up to 80 ft deep. Oil wells present at site (1965) may be inactive now.	Deposits in floodplain permeable; foundations - mats and/or piles up to 160 ft deep.	Deposits in the floodplain permeable; foundations - mats and/or piles up to 150 ft deep.
	SITE DEVELOPMENT	Flat topography; L&N RR; spur ∼1 mi; combined ash and SO_2 storage[a] for 11 years for four units.	Flat to rolling topography; L&N RR; spur ∼1 mi; combined ash and SO_2 storage[a] for 9 years for four units.	Flat topography; C&O RR; spur ∼1 mi; combined ash and SO_2 storage[a] for 5 years for four units.	Flat topography; small ponds & creeks onsite; L&N RR; spur ∼1 mi; combined ash and SO_2 storage[a] for 7 years for four units.
	SPECIAL PROBLEMS	Lining of ash and SO_2 ponds may be necessary; ownership of mineral rights would need to be determined.	Lining of ash and SO_2 ponds may be necessary.	Lining of ash and SO_2 ponds may be necessary; many light duty roads crossing the site would be rerouted.	Lining of ash and SO_2 ponds may be necessary; RR spur crosses a highway.

Table 2.1-4. Summary of Salient Features of Kentucky Utilities Preferred Fossil-Fuel Sites (Sheet 3 of 4)

		G-1	L-8	L-17	O-8	O-11
ENVIRONMENTAL CONSIDERATIONS	CULTURAL RESOURCES	Planned land use is industrial; no recreation in site vicinity; no properties on Nat'l Register; approx. 20 homes to be relocated; little socio-economic impact during construction because of availability of labor within commuting distance.	Approx. 55 homes to be relocated; no properties listed in the Nat'l Register; rec. activities near site; some local opposition anticipated; little socio-economic impact during construction.	No properties on Nat'l Register; some 300 homes to be relocated; cemeteries & churches affected by cooling lake; Daniel Boone Nat'l Forest borders the lake; some local opposition anticipated; little socio-economic impact during construction.	Existing land use industrial; no recreation in site vicinity; no properties on Nat'l Register; approx. 26 homes and 10 trailer homes to be relocated; little socio-economic impact during construction.	Planned land use is industrial; no recreation in site vicinity; no properties listed in the Nat'l Register; approx. 20 homes to be relocated; aesthetic impact upon Lewisport, Ky., close to site; little socio-economic impact during construction.
	ECOLOGY	A few ponds on site; long RR spur crosses two wooded creeks; ash and SO_2 storage areas cover woods, ponds and part of unwooded streams; state endangered species could occur on site.	Cooling lake floods wooded areas and some ponds; ash and SO_2 storage areas cover parts of several wooded creeks; state endangered species could occur on site or in streams that would be flooded.	Cooling lake floods wooded streams; ash and SO_2 storage areas cover wooded slopes; state and federal endangered species could occur on site or in streams that would be flooded.	Ash and SO_2 storage areas cover farmland, small woodlots and unwooded creeks; state endangered species could occur on site.	One important wooded stream and several ponds on site; site is mostly farmland; state endangered species could occur on site.
	METEOROLOGY & AIR QUALITY	Good dispersion; maximum reduction to 73% of the New Source Performance Standards (NSPS) for SO_2 needed for two-unit plant.	Good dispersion; site 20 mi N of Mammoth Cave Nat'l Park, Mandatory Class I Area; max. reduction of 50% of NSPS[b] for TSP might be needed for three- or four-unit plant.	Good dispersion; max. reductions up to 67% of the NSPS[b] for SO_2 needed for four-unit plant.	Good dispersion; maximum reductions of 67% of the NSPS for SO_2 needed for two-unit plant; redesignation of entire Webster County as a NAA may be necessary for more than two-unit plant.	Good dispersion; maximum reductions up to 68% of the NSPS[b] for SO_2 needed for four-unit plant.
	SPECIAL PROBLEMS	The proximity of nonattainment areas restrict the capability of site to support a two-unit plant only.	Large number of homes to be relocated. Since the Mammoth Cave Nat'l Park is a Mandatory Class I Area, pollutant increments allowed are restrictive and may allow the operation of three- or four-unit fossil plant at this site. The endangered Mud Darter, known to occur in this area, could be found in any of creeks that will be flooded.	Severe impact on homes, cemeteries and churches. The endangered Tippecanoe Darter is known to occur in this area.	Provisions needed to protect Williams Cemetery.	

Table 2.1-4. Summary of Salient Features of Kentucky Utilities Preferred Fossil-Fuel Sites (Sheet 4 of 4)

ENVIRONMENTAL CONSIDERATIONS	O-12	O-13	O-22	O-26
CULTURAL RESOURCES	Planned land use is industrial; no recreation in site vicinity; Samuel Pate House 0.5 mi west of the site is listed on Nat'l Register; approx. 15 homes to be relocated; aesthetic impact on nearby communities; little socio-economic impact during construction.	Planned land use is industrial; site is located across from the Hoosier Nat'l Forest in Indiana; approx. 10 homes to be relocated; little socio-economic impact during construction.	Planned land use is industrial; no recreation in site vicinity; no properties listed on the Nat'l Register; approx. 30 homes to be relocated; little socio-economic impact during construction.	Existing and planned land use is industrial; Joseph Holt House & Chapel near the site are listed in Nat'l Register - indirect effects; Holt Bottom Archaeological District near site; approx. 15 homes to be relocated; little socio-economic impact during construction.
ECOLOGY	Site located at base of wooded bluffs and near wooded streams; no endangered species likely to occur on site; several ponds on the site.	Two wooded streams on site; ash and SO_2 storage areas cover woodlot and streams; state and federal endangered species could occur on site.	Farmland and unwooded streams on site; ash and SO_2 storage areas cover unwooded streams and fallow fields; no endangered species likely to occur on site.	Ash and SO_2 storage areas cover ponds and wooded streams; state endangered species could occur on site.
METEOROLOGY & AIR QUALITY	Favorable dispersion; maximum reductions up to 69% of $NSPS^b$ for SO_2 needed for three-unit plant.	Favorable dispersion; maximum reductions up to 68% of the $NSPS^b$ for SO_2 needed for four-unit plant.	Acceptable dispersion; site located in an SO_2 nonattainment area; therefore, emission off-sets are required.	Acceptable dispersion; max. reductions up to 67% of the $NSPS^b$ for SO_2 needed for four-unit plant.
SPECIAL PROBLEMS	Site is close to property nominated for the National Register; the proximity of SO_2 nonattainment restricts the capability of site to support a three-unit plant.		Large number of homes to be relocated. This site will likely require special permit procedures for any plant due to its location; nonattainment area.	Site close to Nat'l Register Property and archaeological district. Air quality monitoring in conjunction with meteorological monitoring might be needed to establish ambient air quality since the dispersion characteristics at site are complex and no air quality monitors are located in the site vicinity.

(Table 2.1-4), low differential site development costs, dependable water supply, favorable dispersion characteristics and air quality considerations, minimum fogging and icing potential for major roads, relatively small land requirements, industrial zoning of the site area, lack of National Register properties, minimum public reaction potential, and availability of a construction labor force.

2.1.3.1.2 Evaluation of the Siting Process

Methodology for evaluating the Applicant's siting process included a review of the site selection study, interviews with the Applicant and the Applicant's consultant, review of additional pertinent information, and a reranking of the sites. The latter activities were applied only to the 9 preferred fossil-fuel sites, accepting the consultant's finding that these were the most favorable of the initial group.

Eleven environmental and three cost factors (Table 2.1-5) were used to compare the 9 sites. Indices were developed for each factor based on 0 as the most favorable site for that factor and 1 for the least favorable. Each site between the extremes was given an index value based on the difference between it and the most favorable site.

Averaging the index values of the environmental variables (without weighting them) shows three distinct groupings (Table 2.1-6). Breckinridge, the most favorably ranked site, is in a group by itself. Hancock and G-1 are the most favorable of the middle group, which includes L-8, 0-8, 0-11 and 0-12. Site L-17, requiring a cooling lake and displacement of 300 houses and several miles of roads, and 0-22, a site in a nonattainment area and near housing projects as well as industry, are clearly the least favorable.

The indices of average cost of site development also separate into three groups (Table 2.1-7). Site G-1 is most favorable, followed closely by the Hancock site. Site 0-12 and the Breckinridge site are the most favorable of the second group, followed by 0-8 and 0-11, respectively. As before, sites 0-22 and L-17 are in the least favorable group and site L-8 joins them.

Costs and effects are combined under a number of scenarios in Table 2.1-8. Each scenario consists of giving a different weight to the contribution of costs and environmental effects. At the far left, cost is considered three times more important to the index than effects. At the far right, the opposite is true and effects are given three times the weight of costs.

Three groups of sites emerge from this analysis. No matter what the weighting, Hancock, Breckinridge, and site G-1 emerge as the most favorable, sites L-17 and 0-22 are the least favorable, and the others tend to be intermediate. When considering cost more important, site G-1 is the most favorable, followed by Hancock and Breckinridge. However, if environmental effects are weighted heavily, Breckinridge is more favorable than G-1, which in turn, is more favorable than Hancock. At equal weighting, little difference exists among the three.

Overall, reranking the 9 alternate sites tends to support selection of the Hancock (0-13) and Breckinridge (0-26) sites among the most favorable.

Table 2.1-5. Variables and Assumptions Used to Compare Kentucky Utilities Preferred Sites

Variable	Assumptions
Environmental Effects	
Extent of Site	Larger sites have greater potential for adverse impacts on land use and natural systems
Length of Railroad Spur	The longer the right-of-way, the greater the potential for adverse impacts
Length of Makeup/ Blowdown Pipeline	Same as above
Length of Transmission Right-of-Way	Same as above
Solid Waste Storage Capacity	The greater the capacity, the less need for offsite shipment and storage
Distance to Nearest Nonattainment Area or Class I Area	The greater the distance, the less chance of exceeding standards
Available SO_2 Increment	The more increment available, the less chance of exceeding standards
Distance to Nearest Airport	The greater the distance, the less chance of accident related to the plant
Proportion of County Cropland Lost to Site Development	The more cropland lost, the greater the adverse effect
Number of Houses To Be Moved	The more movement, the more social disruption and adverse impact
Existing County Employment	The lower the existing employment, the more positive the economic impact of new jobs
Differential Costs	
Construction	The lower the costs, the more advantageous for utility customers
Land	Same as above
Transmission	Same as above

Source: Review of Site Selection Study, Texas Instruments Incorporated (1980).

Table 2.1-6. Index and Rank of KU's Preferred Sites for Each Environmental Variable and for All Environmental Variables

Site	Land Demand		Railroad Spur Length		Pipeline Lengths		Transmission Row Length*		Distance to Nonattainment/ Class I Air Quality		SO_2 Increment Availability		Solid Waste Disposal Demand		Nearest Airport		County Cropland Demand		Houses Moved		Existing County Employment		Average Effects***	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank
G-1	0.06	5	0.70	8	0.67	8	0.05	5	0.72	7	0.60	8	0.56	3	0	1	0.20	2	0.03	4	0	1	0.33	3
L-8	0.91	8	0.24	6	0	1	0.02	4	0.38	4	0.10	4	0.62	4	0.08	2	1.0**	8	0.16	8	0.41	3	0.41	5
L-17	1.0	9	1.0	9	0	1	0	1	0	1	0.26	5	0.90	6	0.54	5	1.0**	8	1.0	9	1.0	9	1.0	9
0-8	0.31	7	0.58	7	1.0	9	0.02	2	0.53	6	0.48	7	0	1	0.46	4	0.32	3	0.06	6	0.80	8	0.55	7
0-11	0.07	6	0	1	0.50	5	0.02	2	0.94	8	0.07	3	0.45	2	0.54	5	0.62	7	0.03	4	0.46	5	0.36	4
0-12	0.03	4	0.11	3	0.50	5	0.16	8	0.44	5	0.32	6	0.87	5	1.0	9	0.48	6	0.02	2	0.46	5	0.43	6
0-13 (Hancock)	0.01	2	0.11	3	0.50	5	0.10	6	0.22	3	0.06	2	0.95	7	0.69	7	0.41	4	0	1	0.46	5	0.31	2
0-22	0	1	0	1	0.33	3	1.0	9	1.0	9	1.0	9	1.0	9	0.69	7	0.43	5	0.14	7	0.41	3	0.86	8
0-26 (Breckinridge)	0.02	3	0.11	3	0.33	3	0.13	7	0.09	2	0	1	0.98	8	0.39	3	0	1	0.02	2	0.06	2	0	1

G = Site on Kentucky's Green River.
L = Sites requiring cooling lakes.
0 = Sites on Kentucky side of Ohio River.

Index: 1 = least favorable; 0 = most favorable.
Rank: 1 = most favorable; 9 = least favorable.

$$I_i = \frac{|X_i - X_m|}{|X_l - X_m|}$$ where

I_i = index for site i

X_i = value for site i

X_m = value for most desirable site

X_l = value for least desirable site

*Based on transmission costs and the assumption of a direct relationship between cost and right-of-way length.

**Accurate estimates not available but losses would be larger than those of other sites.

***Average effects are arithmetic means rescaled to 0 = most favorable and 1 = least favorable.

Source: Review of Site Selection Study, Texas Instruments Incorporated (1980).

Table 2.1-7. Index and Rank of KU's Preferred Sites for Each Cost Variable and for All Cost Variables

	Construction Costs		Land Costs		Transmission Costs		Average Costs*	
Site	Index	Rank	Index	Rank	Index	Rank	Index	Rank
G-1	0	1	0.04	2	0.05	5	0	1
L-8	0.63	5	0.81	8	0.02	2	0.71	7
L-17	1.0	9	1.0	9	0	1	1.0	9
0-8	0.80	7	0.10	6	0.02	2	0.44	6
0-11	0.87	8	0	1	0.02	2	0.44	5
0-12	0.38	3	0.07	4	0.16	8	0.27	3
0-13 (Hancock)	0.11	2	0.06	3	0.10	6	0.09	2
0-22	0.67	6	0.29	7	1.0	9	0.98	8
0-26 (Breckinridge)	0.43	4	0.08	5	0.13	7	0.29	4

G = site on Kentucky's Green River.
L = sites requiring cooling lakes.
0 = sites on Kentucky side of Ohio River.
Index: 1 - least favorable; 0 = most favorable.
Rank: 1 - most favorable; 9 = least favorable.

$I_i = \frac{|X_i - X_m|}{|X_l - X_m|}$ where I_i = index for site i

X_i = value for site i

X_m = value for most desirable site

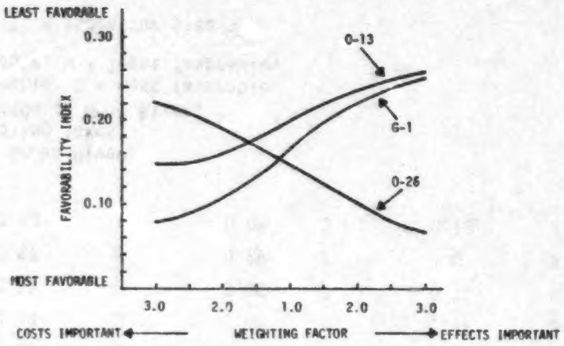
X_l = value for least desirable site

*Average costs are arithmetic means rescaled to 0 = most favorable and 1 = least favorable.

Source: Review of Site Selection Study, Texas Instruments Incorporated (1980).

Table 2.1-8. Ranking of KU's Most Favorable Sites Under Various Scenarios of Effects-Costs Relative Importance

Site	Effects = 3X Costs	Rank	Effects = 2.5X Costs	Rank	Effects = 2X Costs	Rank	Effects = 1.5X Costs	Rank	Effects = Cost	Rank	1.5X Effects = Costs	Rank	2X Effects = Costs	Rank	2.5X Effects = Costs	Rank	3X Effects = Costs	Rank
G-1	0.08	1	0.09	1	0.11	1	0.13	1	0.17	2	0.20	2	0.22	2	0.24	2	0.25	2
L-8	0.64		0.62		0.61		0.59		0.56		0.53		0.51		0.50		0.49	
L-17	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
0-8	0.47		0.47		0.48		0.48		0.50		0.51		0.51		0.52		0.52	
0-11	0.42		0.42		0.41		0.41		0.40		0.39		0.39		0.38		0.38	
0-12	0.31		0.32		0.32		0.33		0.35		0.37		0.38		0.38		0.39	
0-13 (Hancock)	0.15	2	0.15	2	0.16	2	0.18	3	0.20	3	0.22	3	0.24	3	0.25	3	0.26	3
0-22	0.95		0.95		0.94		0.93		0.92		0.91		0.90		0.89		0.89	
0-26 (Breckinridge)	0.22	3	0.21	3	0.19	3	0.17	2	0.15	1	0.12	1	0.10	1	0.08	1	0.07	1



Source: Review of Site Selection Study, Texas Instruments Incorporated (1980).

Site G-1 appears to rank along with them until capability to support four units relative to air quality is considered. Otherwise, site G-1 appears to rank the same as the Hancock site, and the Breckinridge site ranks highest.

2.1.3.2 Hancock Site

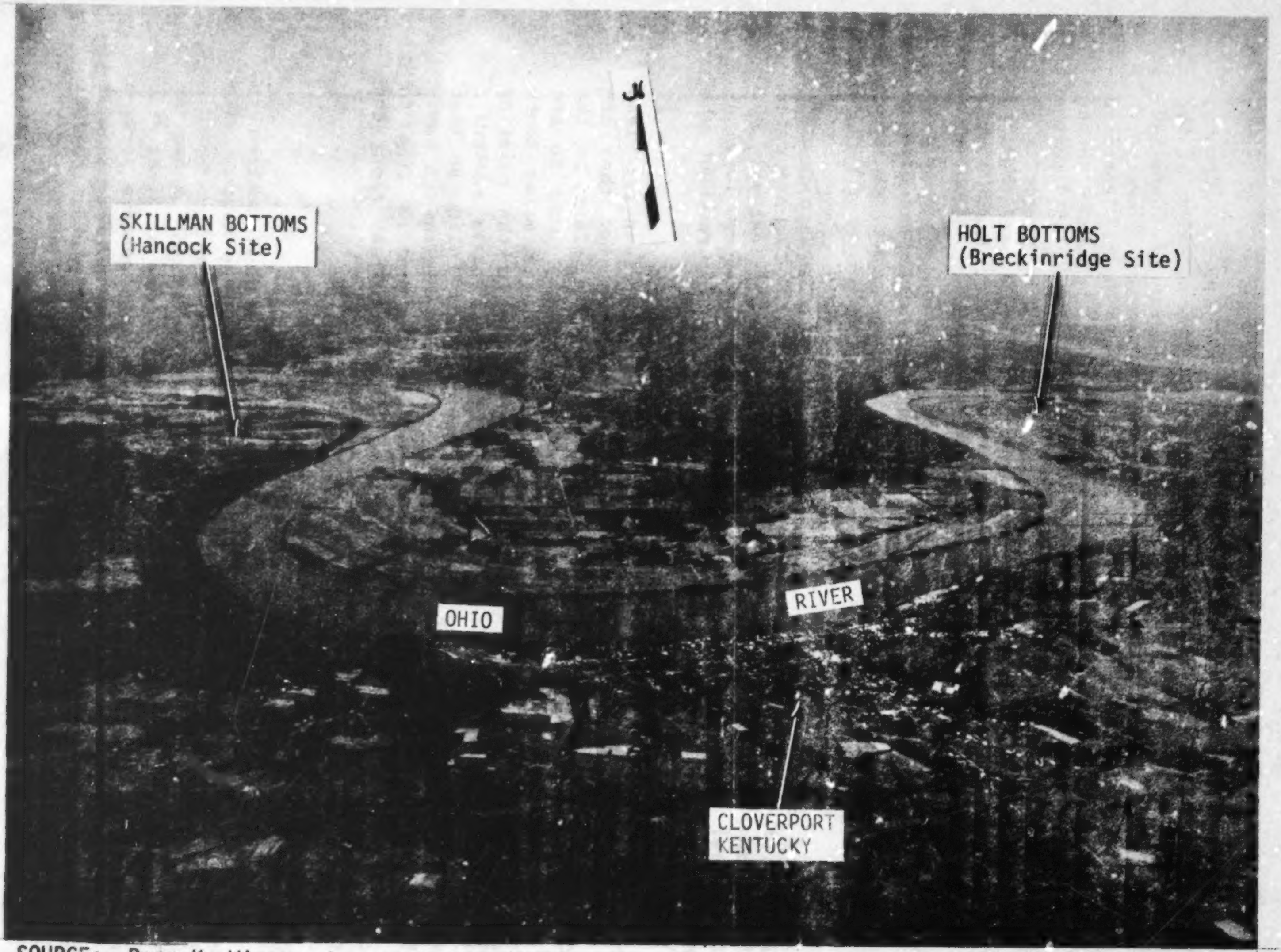
The proposed Hancock site is in Skillman Bottoms in Hancock County, Kentucky at River Mile 715, opposite the Breckinridge site on an oxbow of the Ohio River (Figure 2.1-6). It is approximately 4 miles east of Cannelton, Indiana and Hawesville, Kentucky, and 5 miles northwest of Cloverport, Kentucky at latitude 37° 53' north and longitude 86° 41' west. Portions of the site boundaries abut the Ohio River to the east, U.S. highway 60 to the south, Kentucky highway 1406 to the west, and Skillman Road (Hwy. 1406) to the north. Estimated extent of the site is 2350 acres, and the land presently is owned by 20 parties. Current land use is predominantly agricultural. Most of land is cultivated for cash crops, although there is some cattle and timber production. Drainage of the site is to the west and south into three streams: Sandy Branch, Muddy Branch, and Indian Creek. Elevations range from 399 to 690 feet mean sea level (msl). Ohio River water level at the site is maintained at 382.3 feet msl by the Cannelton Lock and Dam located at River Mile 721.

As mentioned in Subsection 2.1.1.1, development of the Hancock Generating Station will utilize most of the site (Figure 2.1-2). The major facilities will occupy about one-third of the site, graded to 425 feet msl, and solid waste disposal areas will occupy most of the remaining area. Development and reclamation of disposal landfill will be staggered throughout the estimated 35-year life of the project.

Right-of-way alternatives for the new transmission corridor described in Subsection 2.1.1.1 (Figure 2.1-3) have not been proposed, but they are expected to fall within a 1.5-mile area straight from the plant to the Victoria Crossroads tie-in point. Right-of-way width from the plant to the junction of the existing Elizabethtown transmission corridor 5 miles south will be 250 feet. The remaining 5 miles of right-of-way to the existing Owensboro transmission corridor will be 150 feet wide. The entire southward right-of-way will be prepared during construction of the Unit 1 line so that disturbance during construction of the Unit 2 line will be limited to tower placement and stringing activities. Continuation of the Unit 2 line to Elizabethtown will require an additional 100 feet of right-of-way along the existing corridor.

2.1.3.3 Breckinridge Site

The Breckinridge site is at Ohio River Mile 704 in Holt Bottoms in Breckinridge County, Kentucky. It is 11 miles upstream from the Hancock site and 17 miles upstream from the Cannelton Lock and Dam. The nearest town is Cloverport, Kentucky, 6 miles southwest in the bend of the oxbow. A smaller settlement, Stephensport, Kentucky, is somewhat east of the site at River Mile 701. Highway access is via Kentucky 144, which traverses the western portion of the site and borders much of the northern portion. New Bethel Road is near the eastern border. Estimated extent of the site is 2480 acres, and current land use is predominantly agricultural. Drainage of the site, mostly to the


N
SKILLMAN BOTTOMS
(Hancock Site)
HOLT BOTTOMS
(Breckinridge Site)
OHIO
RIVER
CLOVERPORT
KENTUCKY

SOURCE: Donn K. Wimmer, by permission (1980)

Figure 2.1-6. Aerial Photograph of Hancock and Breckinridge Sites

south and southwest, is into Town Creek. Elevations range from 400 to 675 feet msl. Normal Ohio River water level at the site is 382.3 feet msl.

Development of the generating station on the Breckinridge site is shown in Figure 2.1-7. The major facilities will occupy lower elevations, with grade established at 430 feet msl. As on the Hancock site, plant facilities will utilize about one-third of the land and waste disposal landfill will be developed on the remaining area. The waste disposal areas will be developed and reclaimed in increments.

Transmission facilities for the Breckinridge Generating Station will be similar to those for the Hancock plant, except that Unit 1 transmission will tie into the Owensboro system near McQuady, Kentucky in Breckinridge County (Figure 2.1-3). Right-of-way (ROW) widths will be the same as described for the Hancock system. Length for Unit 1 ROW will be 15 miles and that for Unit 2 will be 6 miles to the Elizabethtown corridor and 40 miles from there to Elizabethtown.

2.1.4 Alternative Plant Systems

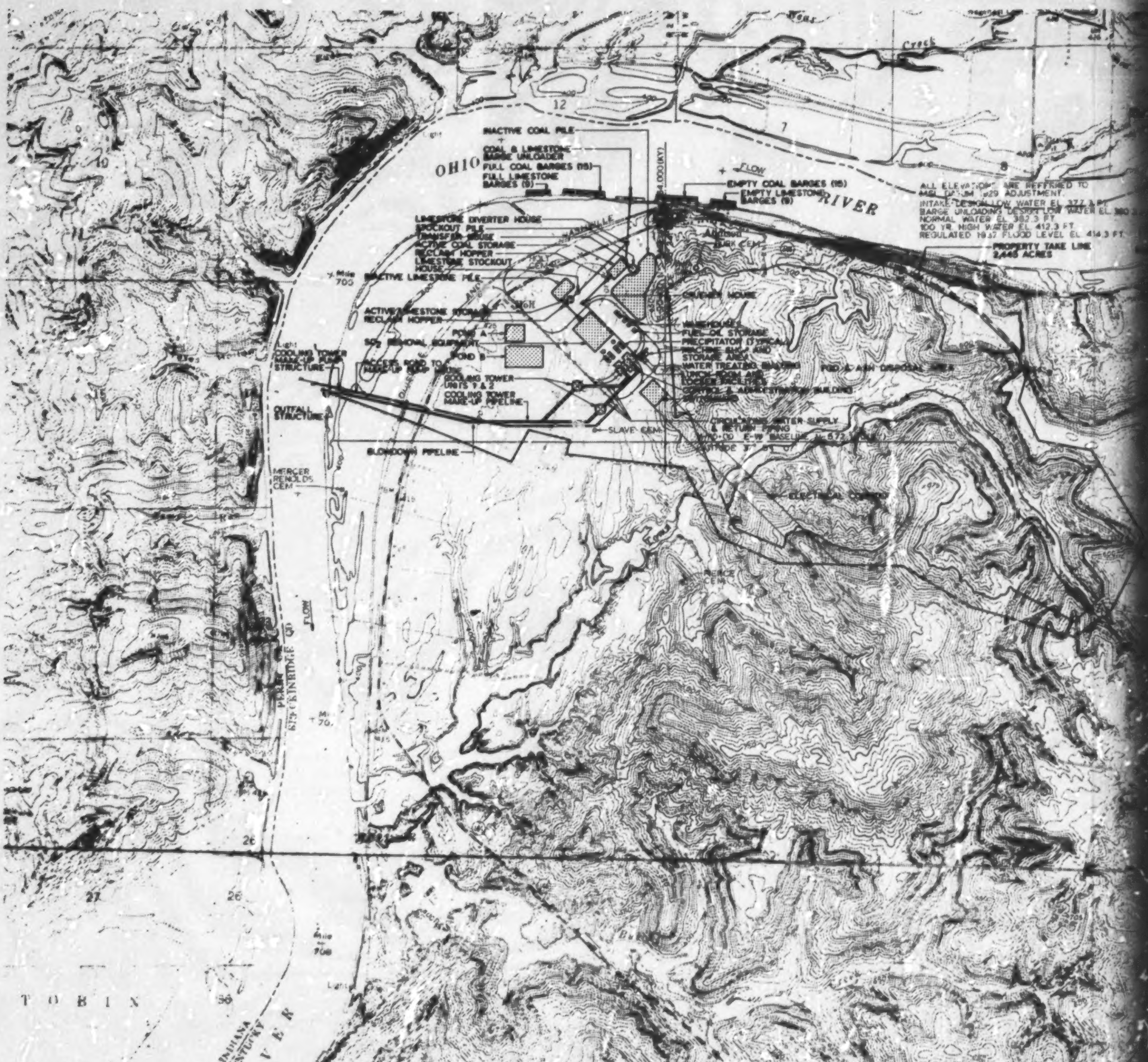
2.1.4.1 Generating Station

Major facilities proposed for the generating station will include a two-part main building to house the steam generator (boiler), turbine-generator, and auxiliary equipment of each generating unit. Each unit of the main building will be 266 feet high, the equivalent of a 26-story building. Four electrostatic precipators (ESP) will collect fly ash from the flue gas exiting the boilers. Two 600-foot chimneys (Table 2.1-9), located at UTM 527.9E and 4193.2N on the Hancock site, will discharge emissions from the flue gas desulfurization (FGD) system. Two 250-foot diameter by 60-foot high mechanical draft cooling towers are proposed for the circulating water system. The remainder of the facilities will consist of a coal and limestone handling system, barge unloading structures, water intake and discharge structures, and a 345-kV switchyard and transmission system.

The generating station on the Breckinridge site would be similar. At that site, the chimneys will be located at latitude 37° 45' north and longitude 86° 34' west. Differences in the design and operating parameters would be:

Flue Gas Desulfurization System	
SO_2 removal efficiency (overall)	90.5%
Chimney	
Base elevation above sea level	430 feet

Cost of constructing the generating station on the Hancock site is expected to be \$1.8 billion (Table 2.1-10) and about \$10 million more than that on the Breckinridge site because of site conditions. Construction activities associated with the plant (at either site) will have two peaks, one in 1987-1988 requiring 920 to 980 persons, and one in 1992 requiring about 920 workers (Table 2.1-11). About 5% (\$57 million) of total equipment, structural and other materials, and services costs is expected to be spent in the


OHIO RIVER
FLOW
INACTIVE COAL PILE
COAL & LIMESTONE BARGE UNLOADER
FULL COAL BARGES (15)
FULL LIMESTONE BARGES (9)
EMPTY COAL BARGES (15)
EMPTY LIMESTONE BARGES (9)
LIMESTONE DIVERTER HOUSE
STOCKOUT PILE
TRANSFER HOUSE
ACTIVE COAL STORAGE
RECLAIM HOPPER
LIMESTONE STOCKOUT HOUSE
INACTIVE LIMESTONE PILE
ACTIVE LIMESTONE STORAGE
RECLAIM HOPPER
POND A
SO2 REMOVAL EQUIPMENT
POND B
COOLING TOWER MAKE-UP PUMP STRUCTURE
ACCESS ROAD TO MAKE-UP PUMP HOUSE
COOLING TOWER UNITS 1 & 2
COOLING TOWER MAKE-UP PIPELINE
OUTFALL STRUCTURE
SLAVE CEM
BLOWDOWN PIPELINE
MERCER RENOLDS CEM
CRUSHER HOUSE
WAREHOUSE
FUEL OIL STORAGE
PRECIPITATOR (TYPICAL)
MACHINE SHOP AND STORAGE AREA
WATER TREATING BUILDING
LUNCH ROOM AND LOCKER FACILITIES
CONTROL & ADMINISTRATION BUILDING
POND & ASH DISPOSAL AREA
CIRCULATING WATER SUPPLY & RETURN PIPING
ELECTRICAL CORRIDOR
PIERCE CEM
ALL ELEVATIONS ARE REFERRED TO MSL DATUM 1929 ADJUSTMENT.
INTAKE DESIGN LOW WATER EL 377.3 FT
BARGE UNLOADING DESIGN LOW WATER EL 380
NORMAL WATER EL 382.3 FT
100 YR. HIGH WATER EL 412.3 FT
REGULATED 1937 FLOOD LEVEL EL 414.3 FT
PROPERTY TAKE LINE 2,445 ACRES
Mile 705
Mile 706
BRECKINRIDGE
TOBIN
INDIANA
KENTUCKY
RIVER
Creek
12
7
8
26
27
34
36

SOURCE: Sargent & Lundy (1980)

Figure 2.1-7. Proposed Breckinridge Site Layout

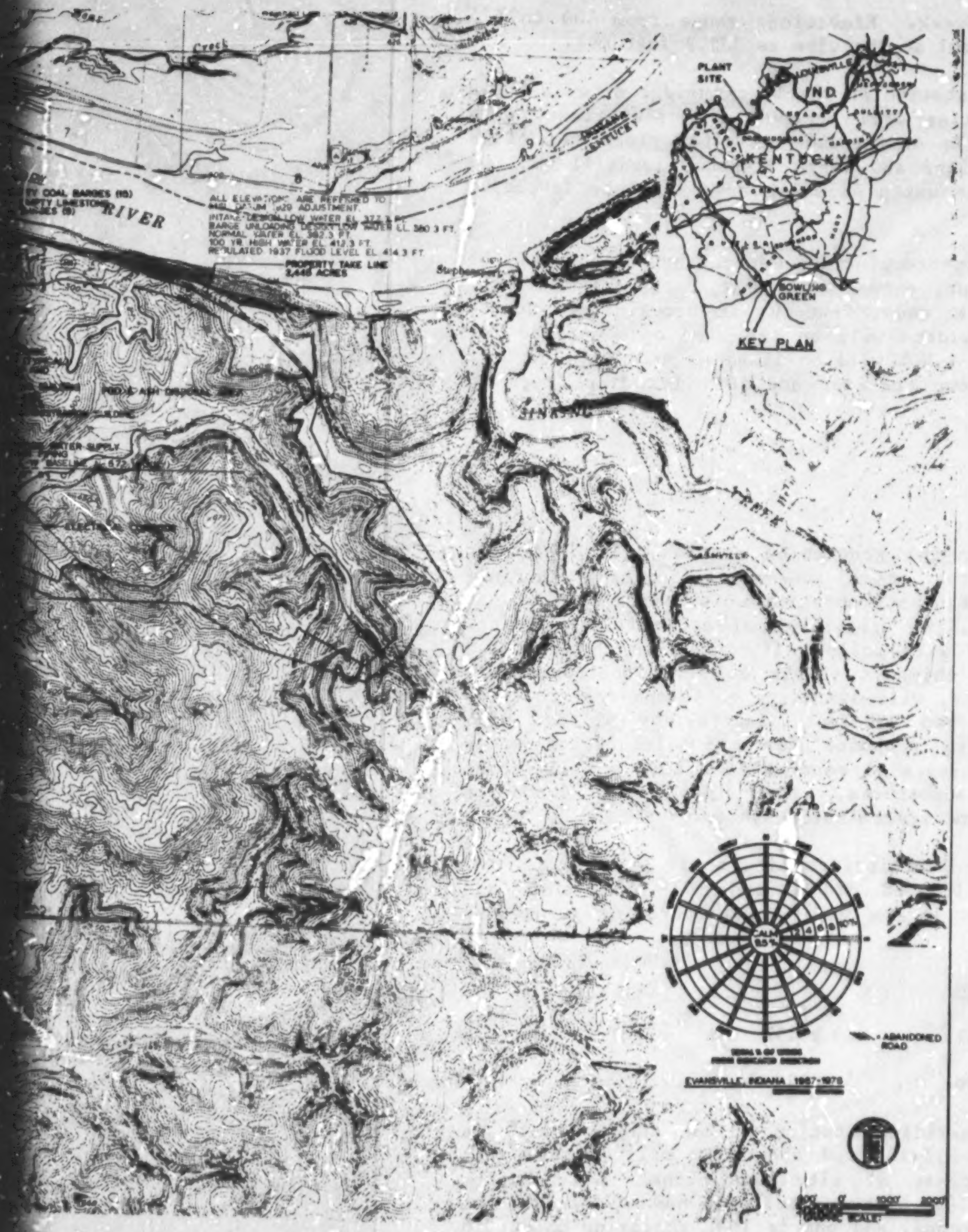
Creek
7
8
9
INDIANA
KENTUCKY
RIVER
TY COAL BARGES (15)
PTY LIMESTONE
ES (9)
ALL ELEVATIONS ARE REFERRED TO
MSL DATUM 1929 ADJUSTMENT
INTAKE DESIGN LOW WATER EL 372.3 FT.
BARGE UNLOADING DESIGN LOW WATER EL 380.3 FT.
NORMAL WATER EL 382.3 FT.
100 YR. HIGH WATER EL 412.3 FT.
REGULATED 1937 FLOOD LEVEL EL 414.3 FT.
PROPERTY TAKE LINE
2,446 ACRES
Stephensport
FLY ASH DISPOSAL AREA
SINKING
CREEK
ELECTRICAL
PLANT SITE
OHIO
IND.
LOUISVILLE
KENTUCKY
BOWLING GREEN
KEY PLAN
CALM
8.5 %
2 4 6 8 10 %
EVANSVILLE, INDIANA 1967-1975
ABANDONED ROAD
1000' 0 1000' 2000'
GRAPHIC SCALE

Table 2.1-9. Design and Operating Parameters, Hancock Generating Station Units 1 and 2

Steam Generating Unit	
Electric generating capacity	
Maximum gross	708 MW
Maximum net	650 MW
Average annual	54%
Maximum heat input to boiler	6650×10^6 Btu/hr
Maximum coal consumption rate	317 tons/hr
Typical heating value of coal	10,500 Btu/lb
Maximum continuous main steam output	4.97×10^6 lb/hr
Turbine generator speed	3600 rpm
Electrostatic Precipitators (ESP)	
Collection efficiency	99.78%
Collection area (SCA)	400 to 430 ft^2/1000 ACFM
Flue gas	
Discharge flow rate to ESPs	2.48×10^6 ft^3/min (ACFM)
Maximum linear velocity through each ESP module	5.0 ft/sec
Maximum opacity of exiting ESP	20%
Flue Gas Desulfurization System (FGD)	
SO_2 removal efficiency (overall)	91.8%
Range of pressure drop across system	4 to 20 in. H_2O
pH of reactant tank liquor	5.5 to 6.5
Flue gas	
Approach velocity	10 to 17 ft/sec
Exit velocity (from chimney)	90 ft/sec
Exit temperature	170°F
Discharge flow rate	2.484×10^6 cu. ft/min at 170°F
Maximum opacity exiting FGD system	20%
Chimney	
Diameter (inside)	24.2 ft
Base elevation above sea level	425 ft
Height	600 ft

Source: Kentucky Utilities Company (1980).

Table 2.1-10. Capital Outlay Per Year for Construction of Hancock Generating Station Units 1 and 2

Year	Contractors* ($000)	Heavy Equipment, Structural Materials, Non-Local Services** ($000)	Light Equipment, Goods, Local Services *** ($000)	Total ($000)
1980	–	422	–	422
1981	–	2,135	–	2,135
1982	1,048	3,921	206	5,175
1983	2,212	8,665	456	11,333
1984	12,733	42,921	2,259	57,913
1985	28,900	106,531	5,607	141,038
1986	51,267	209,959	11,050	272,276
1987	86,630	164,647	8,666	259,943
1988	114,186	3,964	209	118,359
1989	18,678	13,294	700	32,672
1990	20,517	75,507	3,974	99,998
1991	64,121	186,470	9,814	260,405
1992	146,772	212,201	11,169	370,142
1993	88,751	58,684	3,089	150,524
1994	12,738	–	–	12,738
Total	648,553	1,089,321	57,199	1,795,073

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*Contractors' cost = salaries, overhead, and profits.

**Heavy equipment, structural materials, and non-local services will be purchased outside the project area.

***Light equipment, goods, and services, estimated at 5% total costs (excluding labor), will be purchased locally, to the extent possible.

Source: Kentucky Utilities Company (1981).

project area if suppliers are available. These items would include, among others, lumber, hardware, automobiles, office trailers, and office supplies.

Unit 1 is proposed to begin commercial operation in April 1989 and Unit 2 in April 1994. The projected life of each generating unit is 35 years, so that Unit 1 will operate through 2024 and Unit 2 through 2029. Although the plant will operate at or near maximum capacity on occasion, the annual load factor will be about 54%.

The labor force expected to be required to operate one unit of the power plant is 130 and that expected to operate both units is 180.

Personnel within 4 categories will be:

Category	Number of Workers	
	One Unit	Two Units
Operation	47	63
Maintenance	51	72
Supervisory	17	23
Other	15	22
TOTAL	130	180

Table 2.1-11. Manpower Demands and Salaries for Constructing Hancock Generating Station Units 1 and 2*

	1982		1983		1984		1985		1986		1987		1988	
Workforce	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)
Manual														
Carpenter	2	71	4	151	36	1,482	56	2,528	60	2,934	62	3,305	39	2,267
Laborer	10	261	16	444	26	785	26	856	40	1,436	46	1,800	36	1,542
Operator	6	208	12	443	14	562	42	1,840	80	3,820	82	4,268	53	3,010
Ironworker	–	–	–	–	34	1,632	74	3,871	114	6,500	88	5,469	50	3,387
Boilermaker	–	–	–	–	12	571	32	1,660	66	3,733	114	7,029	146	9,810
Pipefitter	–	–	2	92	10	501	36	1,966	52	3,094	126	8,172	148	10,463
Electrician	–	–	2	80	12	521	18	852	40	2,065	64	3,600	116	7,115
Millwright	–	–	–	–	–	–	–	–	26	1,352	116	6,573	132	8,156
Insulator	–	–	–	–	–	–	12	595	40	2,161	82	4,830	138	8,861
Other	–	–	–	–	14	584	14	636	20	991	50	2,702	30	1,767
Subtotal	18	540	36	1,210	158	6,638	310	14,804	538	28,086	830	47,748	888	56,378
Nonmanual														
Supervisor	1	50	1	54	3	177	5	372	8	561	13	993	16	1,332
Field Engineer	1	60	1	65	5	354	12	926	23	1,934	29	2,659	29	2,898
Cost/Schedule	–	–	–	–	1	53	2	116	4	252	8	550	8	600
Field Procedure	–	–	1	36	1	38	2	84	4	182	8	397	8	433
Administration	–	–	1	35	4	153	7	293	19	866	29	1,440	27	1,461
Safety/First Aid	1	45	1	49	2	106	2	116	2	126	3	206	5	375
Subtotal	3	155	5	238	16	881	30	1,857	60	3,921	90	6,245	93	7,099
Total	21	695	41	1,448	174	7,519	340	16,661	598	32,007	920	53,993	981	63,477

	1989		1990		1991		1992		1993		1994	
Workforce	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)	Workers	Total ($000)
Manual												
Carpenter	10	609	30	2,072	42	3,161	54	4,431	38	3,398	2	183
Laborer	22	1,007	18	902	22	1,140	40	2,210	24	1,445	4	248
Operator	15	905	12	809	18	1,323	34	2,723	20	1,745	2	182
Ironworker	6	415	20	1,570	44	3,860	108	10,327	56	5,837	2	213
Boilermaker	20	1,587	10	799	112	9,748	182	17,264	52	5,377	2	220
Pipefitter	12	904	8	672	52	4,761	148	14,770	104	11,314	10	1,186
Electrician	22	1,271	10	729	32	2,542	98	8,485	64	6,040	10	978
Millwright	8	505	8	588	12	960	44	3,837	26	2,472	8	777
Insulator	16	1,049	–	–	34	2,827	104	9,428	58	5,730	10	1,009
Other	10	601	12	840	14	1,068	38	3,159	16	1,450	–	–
Subtotal	141	8,853	128	8,981	382	31,390	850	76,634	458	44,808	50	4,996
Nonmanual												
Supervisor	4	363	3	297	7	755	11	1,293	11	1,409	3	419
Field Engineer	6	654	5	594	17	2,200	23	3,244	24	3,690	4	670
Cost/Schedule	2	163	2	178	5	405	5	529	5	577	2	251
Field Procedure	2	118	2	129	5	360	6	458	6	500	1	91
Administration	4	236	4	257	10	701	18	1,375	18	1,499	4	363
Safety/First Aid	2	164	1	89	2	194	3	317	3	346	1	126
Subtotal	20	1,698	17	1,544	46	4,685	66	7,216	67	8,021	15	1,920
Total	161	10,551	145	10,525	428	36,075	916	83,850	525	52,829	65	6,916

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*Salaries are based on adjusted dollars for each year of construction.

Source: Kentucky Utilities Company (1981).

Projected total salaries through the life of the plant are shown in Figure 2.1-8. In 1989 dollars, the value of the labor salaries for the 35-year operation of both units is $146 million.

The proposed coal-fired steam generators (Figure 2.1-9) will be balanced-draft reheat drum type boilers with a maximum continuous main steam output of 4,970,000 lb/hr (Table 2.1-9). A primary air system with three primary air fans, two vertical shaft regenerative type air heaters, and two forced-draft fans will supply the combustion air, while coal feeders, pulverizers, and boiler feedwater pumps will supply the fuel and water for each boiler. Four induced-draft fans will draw the combustion gases (flue gas) from the boilers through the particulate removal system and force them into the FGD system and then to the chimneys. A water-filled hopper will collect ash remaining in each furnace. This waste will be sluiced, along with pulverizer rejects (pyrites), to a bottom-ash dewatering bin and then to the waste stablization system.

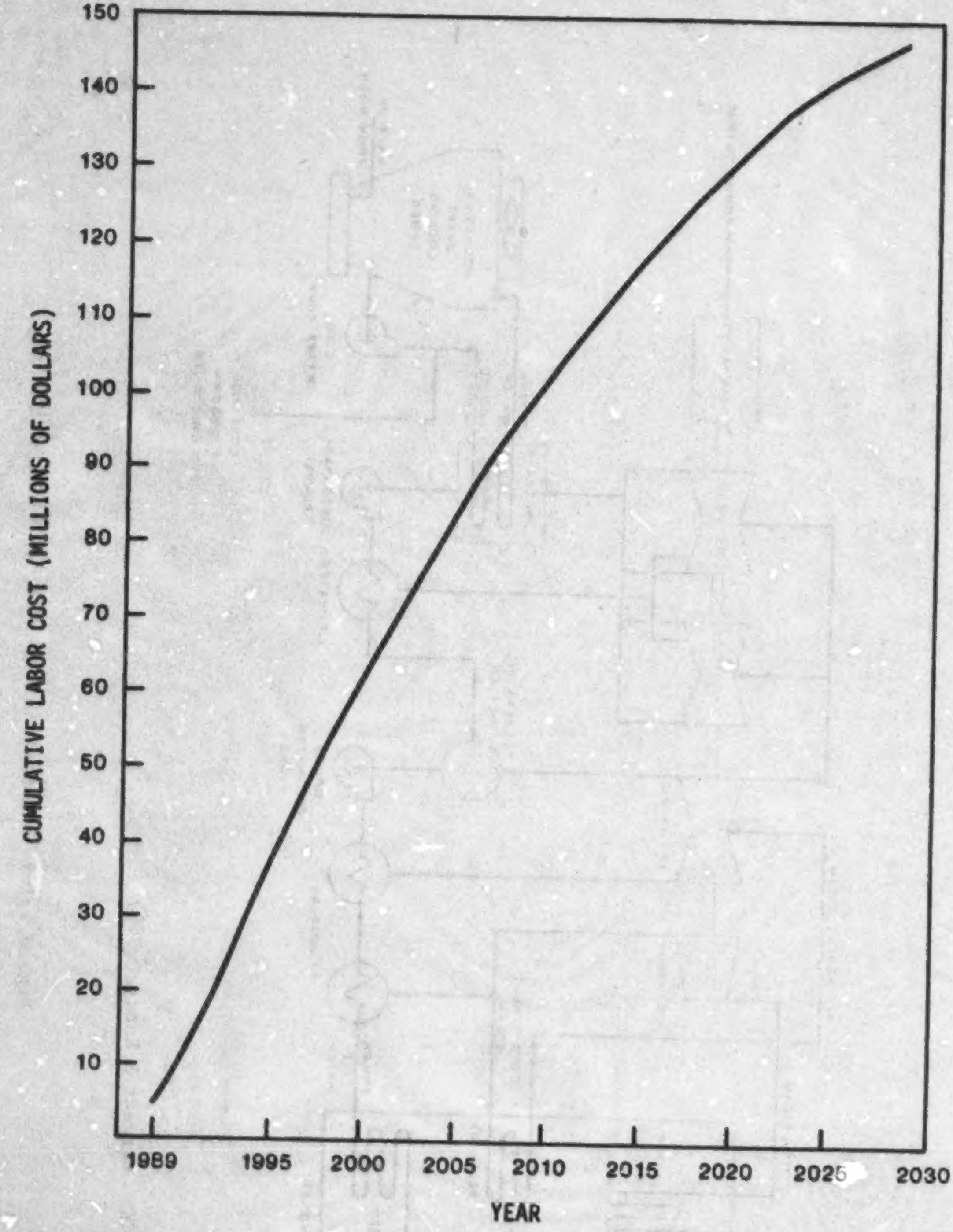
Accessories associated with the steam generators to improve overall operating efficiency include an economizer, which is a heat recovery device in the boiler that transfers heat from passing flue gas to the boiler feedwater. The air heaters, as mentioned, will act as recuperative heat exchangers, using waste heat from the flue gas to preheat combustion air before it enters the boiler. Noise associated with the boilers will be abated by equipping air fans with either inlet or discharge silencers and through the application of acoustic insulation.

During the steam cycle, superheated main steam from the boiler will enter the high-pressure turbine, be expanded, and returned to a reheating unit in the boiler. The reheated steam will go first to the intermediate-pressure turbine for further expansion and then to each of the two low-pressure turbines, which will further expand the steam and exhaust it to a shell-and-tube condenser. In the condenser, heat will transfer from the steam to circulating water, which will be returned to the cooling tower where heat will be dissipated to the atmosphere. The condensed steam will be pumped back to the boiler as part of the boiler feedwater.

On the way to the boiler, the feedwater will pass through a series of tubular heaters and a direct contact heater from each turbine. Heat of condensation from steam in the turbines will transfer to the feedwater. This regenerative type feedwater heating and the boiler reheat of steam exhausted from the high-pressure turbine will increase the turbine cycle efficiency and reduce thermal discharge.

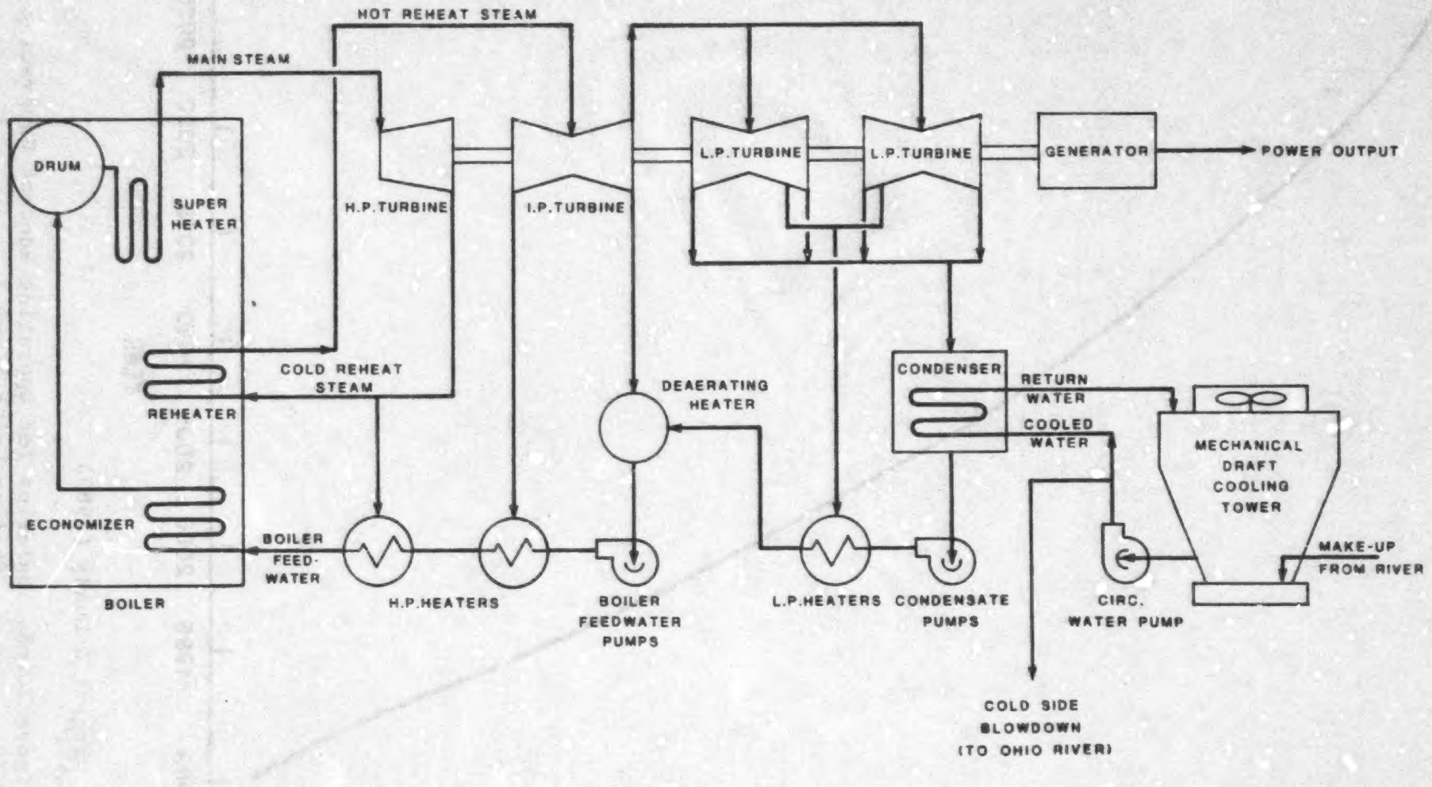
To supplement start-up steam requirements at initial operation or when the main boilers are out of service, an auxiliary oil-fired boiler will generate 75,000 lb/hr steam, operating with less than 100 million Btu/hr total heat input. Low-sulfur fuel oil will be used, and the manufacturer has guaranteed that all applicable emissions standards will be met.

Maximum coal consumption for Hancock Units 1 and 2 will be 317 tons per hour per unit. For both units operating at normal load (54% of capacity), annual consumption will be 3 million tons. For the life of the plant (35 years), both units will use 105 million tons. Delivery of the coal is planned to be by barge. Based on 1500-ton capacity, average annual coal consumption



SOURCE: Sargent & Lundy (1980)

Figure 2.1-8. Salaries for Operating Hancock Generating Station Units 1 and 2


HOT REHEAT STEAM
MAIN STEAM
DRUM
SUPER HEATER
H.P.TURBINE
I.P.TURBINE
L.P.TURBINE
L.P.TURBINE
GENERATOR
POWER OUTPUT
REHEATER
COLD REHEAT STEAM
DEAERATING HEATER
CONDENSER
RETURN WATER
COOLED WATER
MECHANICAL DRAFT COOLING TOWER
ECONOMIZER
BOILER FEED-WATER
BOILER
H.P.HEATERS
BOILER FEEDWATER PUMPS
L.P.HEATERS
CONDENSATE PUMPS
CIRC. WATER PUMP
MAKE-UP FROM RIVER
COLD SIDE BLOWDOWN (TO OHIO RIVER)

SOURCE: Sargent & Lundy (1980)

Figure 2.1-9. Generating Unit Functional Flow Diagram

will require 6 to 7 barge loads per day.

An active coal supply containing 2 days requirements at full load will be maintained in silos. An open, inactive onsite storage pile will contain 1.4 million tons, have 40° side slopes, be 50 feet high, and occupy 22 acres. No lining is proposed to mitigate leaching, but runoff will be treated (see Subsection 2.1.4.3.5.2), and the storage pile will be compacted regularly and watered as necessary to reduce fugitive dust emissions. Leachate from the coal pile will increase trace element levels in soil, vegetation, and groundwater. A groundwater monitor near the storage pile will ensure no long-term impact on potable groundwater. KU's groundwater monitoring plan is a condition of the NPDES permit, Part III (see Appendix 8.1).

2.1.4.2 Emissions Control and Waste Stabilization

The Applicant proposes an integral particulate removal system, sulfur dioxide removal system, and waste stabilization system to control particulate (TSP) and sulfur dioxide (SO_2) emissions and treat resultant solid wastes. Nitrogen oxide (the other regulated pollutant in emissions from coal-fired power plants) and minor pollutant emissions will be controlled by the boiler operation. During boiler operation, excess air will be provided to the furnaces to reduce formation of carbon, carbon monoxide, and hydrocarbons, which are products of incomplete combustion. Residence time of the combustion materials will then be limited in order to maintain NO_x formation within air quality standards (Table 2.1-12). Because limitations on residence time reduce combustion efficiency, this method of NO_x control is a trade-off between NO_x and carbon monoxide production. In practice, the two effects will be optimized to avoid excessive emissions of either pollutant, as guaranteed by the boiler manufacturer.

2.1.4.2.1 Particulate Control

Electrostatic Precipitators. Two electrostatic precipitators, operating in parallel, are proposed to collect ash suspended in combustion gases of each unit and maintain acceptable particulate emissions (Table 2.1-12). Design efficiency of the precipitators will be 99.78%. Eighty-five percent of the coal ash is expected to be fly ash and the remainder bottom ash, although some of the heavier fly ash will fall into the hoppers and be treated with the bottom ash. Most of the remaining fly ash will be collected dry from flue gas by negatively charging the ash particles and attracting them to positively charged plates. At suitable intervals the collecting plates are rapped to release the particles. The particles will be collected in hoppers beneath the precipitators, conveyed pneumatically through a pipeline to a storage silo, and later transported dry to the waste stabilization system. Annual total ash (bottom and fly) for both generating units at 54% capacity will be 435,000 tons, of which 370 thousand tons will be fly ash.

Fabric Filters. Collection of fly ash by filtration through porous fabrics was the alternate particulate removal system considered by KU. In this system, the flue gas is pulled or pushed through a filterhouse (baghouse) containing a number of cylindrical fabric bags that are supported within a housing. Dust buildup on the filter surfaces is removed by reverse flow (backwash), shaking, rapping, vibrating, or a combination thereof. Collection efficiency is high but reliability for cycling large coal-fired power plants for extended operating periods has not been demonstrated (Table 2.1-13).

Table 2.1-12. Emissions Characteristics, Hancock Generating Station Units 1 and 2

	Maximum Uncontrolled (each unit)	54% Capacity Uncontrolled (each unit)	Actual Maximum (each unit)	Actual 54% Capacity (each unit)	Allowable New Source Performance Standards (NSPS) (each unit)
Flue Gas					
Sulfur dioxide	44,356 lb/hour 6.6 lb/million Btu	104,911 tons/year	3,637 lb/hour 0.54 lb/million Btu	8,602 tons/year	4189.5 lb/hour 0.63 lb/million Btu
Particulate	78,100 lb/hour 11.9 lb/million Btu	184,486 tons/year	172 lb/hour 0.03 lb/million Btu	407 tons/year	199.5 lb/hour 0.03 lb/million Btu
Nitrogen oxides	8645 lb/hour 1.3 lb/million Btu	20,447 tons/year 9,437 tons/year	3990 lb/hour 0.6 lb/million Btu*	9437 tons/year	3990 lb/hour 0.6 lb/million Btu

	24-hr Maximum Controlled	Annual Average Controlled
Fugitive Emissions*	17.7 lb/hour 425.1 lb/day	8.2 lb/hour 35.9 tons/year

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*Includes coal and limestone handling and waste stabilization building.

Source: Kentucky Utilities Company (1981).

Table 2.1-13. Comparison of Emissions (TSP and SO_2) Control Processes

System	Advantages	Disadvantages
Particulate Control		
Electrostatic precipitators	Low maintenance. Suitable for extended operation. Particle collection efficient. Particle removal efficient.	Collection efficiency affected by particle resistivity, therefore could be affected by changing coal sources.
Fabric filters	High collection efficiency for wide range of particle sizes. Not affected by particle resistivity.	Frequent maintenance and repair due to short bag life (2 years) Sensitive to acid dew point variations. Reliability of long-term performance for large-scale cycling power plants not demonstrated.
Sulfur Removal/Control		
Pyrite removal in pulverizers	Removes about 20% of pyritic sulfur. Intrinsic process requiring no additional cost or energy use. 5% reduction of SO_2 emissions.	Requires high-efficiency SO_2 removal system.
Capture by flyash alkalinity	Intrinsic process. 5% removal of available sulfur in bituminous coal.	Requires high-efficiency SO_2 removal system.
Coal washing (pretreatment)	Removes most of pyritic sulfur from pulverized coal.	Economical only for certain pyrite sizes and distributions. Only 45% of total sulfur content removed with 90% pyrite removal if pyrite is a significant portion of sulfur content.
Coal mixing (pretreatment)	Mixing variable sulfur content coal prior to pulverizing can ensure that the average analysis fuel will be fired.	Requires stackers and special reclaimers for coal placement and removal from the active coal pile. Power requirement is 425 kilowatts. Usefulness minimal because of limited range of coals available to meet specified sulfur content.
Coal conversion	SO_2 removal systems not needed because solvent refining or gasification produces essentially sulfur-free liquified coal or synthetic gas.	Not proven for large-scale utility operations.
Fluidized bed combustion	SO_2 removal eliminated by burning coal in a fluidized bed of limestone to form calcium sulfate, a particulate that could be filtered from flue gas or otherwise removed.	Not commercially available for large-scale utility operations.
SO_2 Removal Systems		
Limestone scrubber	Limestone is readily available in or near the project area and less costly than other reactants. Limestone preparation is less energy intensive than lime preparation. Waste is more easily dewatered than lime-produced waste. Proven technology.	May have highest installed equipment cost. Produces most waste. Requires an open limestone stockpile.
Lime scrubber	Lowest installed equipment cost. Less waste than limestone scrubber. Lower manpower and system energy requirements than limestone scrubber. Enclosed storage.	Waste difficult to dewater. May require a holding pond for FGD sludge.
Double-alkali scrubber	Highest operating efficiency, with lower liquid circulation rate and nonscaling reactant. Least amount of waste produced. Potential for least environmental effects.	Costs somewhat higher than lime scrubber. Not demonstrated on commercial installations similar to the Hancock plant.

Sources: Kentucky Utilities Company (1979); Sargent and Lundy (1979).

2.1.4.2.2 Sulfur Dioxide Control

To maintain air quality standards, use of high-sulfur coal may require some kind of pretreatment of coal (Table 2.1-13), as well as a system for flue gas desulfurization. Methods that will remove virtually all sulfur (pyritic, sulfate, organic) from coal prior to combustion (coal conversion) or during combustion (fluidized bed combustion) are not commercially available for large-scale utility installations. Rather than pretreatment, Kentucky Utilities proposes to use a coal source with guaranteed maximum sulfur content and a compatible SO_2 removal system (scrubber) that will meet air quality standards (Table 2.1-12). Two intrinsic processes - partial (20%) pyrite removal during coal pulverizing (for 5% SO_2 reduction) and absorption of some of the sulfur oxides produced during combustion by alkalinity of the fly ash (for 5% available sulfur reduction) - will provide part of the overall 91.8% SO_2 collection efficiency expected from the system (Table 2.1-9). Three types of scrubber systems were considered: limestone, lime, and double-alkali.

Limestone Scrubber. The FGD system proposed for the Hancock Generating Station will be designed to operate continuously and to maintain performance during all modes of boiler operation, including various boiler loads and sulfur content of the coal. The expected number of SO_2 absorber modules is 3 to 5, with one always removed from service for inspection and maintenance.

Removal of SO_2 will occur as flue gas is forced from the electrostatic precipitators into the absorbers, which will be fed with limestone reactant in the form of a slurry. SO_2 will react with the calcium-based alkali to form calcium sulfite. This and the reactant slurry will be agitated in a reactant recirculating tank. Capacity of each tank will be sufficient for completing the reaction to calcium sulfate, which will precipitate while the reactant slurry is recirculating through the absorbers. Flue gas exiting the absorbers will be reheated by hot air injection or by passing it through a reheat exchanger. A mist eliminator system with demister sprays and soot blowers will remove entrained moisture and particulate matter before the flue gas exhausts into the chimneys. Waste slurry will be discharged to a surge tank and then to the waste stabilization system.

The limestone scrubber will produce more waste than either the lime c- double alkali system (Table 2.1-13). Unless the waste is cycled for other uses (described in the next subsection), the limestone system will create the greatest waste disposal problem. Since KU proposes onsite waste disposal, landfill area and subsequent effects (e.g., topographic and soil changes) will be greater than might be expected with the other alternatives.

This system will require an open limestone stockpile. It is proposed to contain 1.8 thousand tons of 3/4 inch pebbles that will be piled 30 feet high and occupy 7 acres. Runoff from the pile will be diverted to a closed-system holding pond. No lining is proposed to mitigate leaching, but effects of calcium carbonate leaching (primarily PH changes) apparently are minimal in most locations (U.S. Fish and Wildlife Service 1978). Similarly, fallout of fugitive emissions from the pile apparently will have limited chemical effects, although nearby vegetation may be coated with the dust and experience stress related to transpiration and other leaf activities.

Grinding of the limestone prior to slurrying will be done in silos to minimize fugitive emissions from the small particles.

Limestone consumption at the Hancock plant will average 335,000 tons per year. Based on 1500-ton capacity, delivery of the limestone will require less than 1 barge each day or 220 per year. Maximum generating capacity will use 35 tons of limestone each hour for each unit.

Lime Scrubber. This system uses lime that is hydrated in a slaker, slurried, and pumped to the SO_2 absorbers. The reaction in the scrubber modules is similar to that of limestone.

Enclosed storage alleviates the effects of fugitive emissions from open stockpiles, but difficulties in dewatering the waste could require holding the FGD sludge in a pond rather than sending it from the FGD system to the stablilization system. This would create a greater potential for leaching than does the stablized waste (Table 2.1-13).

Double-alkali scrubber. A highly reactive, soluble, nonscaling sodium-based scrubbing solution is pumped to the SO_2 absorbers and the cleaned gas is released through the chimneys. The solution from the scrubber is divided into a large and small stream. The larger stream recirculates to the scrubber and the smaller one goes to a reactant tank that contains limestone or lime and precipitates calcium sulfite and sulfate. The waste stabilization system accepts the slurry from the reactant tank and via a vacuum filter process produces a sulfate filter cake that is disposed of in a landfill.

In addition to other advantages, this scrubber potentially could produce fewer indirect environmental effects than the others. However, at this point it has been demonstrated only as a prototype system and is not a proven technology.

2.1.4.2.3 Solid Waste Disposal

The generating station will produce three solid wastes: slurry from the FGD system, fly ash from the electrostatic precipitators, and bottom ash and pyrites that are collected in the boiler hoppers and sent to dewatering bins. The Applicant proposes a waste stabilization process that produces a cementitious aggregate suitable for onsite storage in ravines. Other solid waste disposal methods that were considered included ponding, sale of solid wastes, and blending of solid wastes with no further treatment.

Stabilized Waste. The proposed system consists of thickeners that will dewater the slurry from the FGD system and a central filter-blending facility that will combine this sludge and the hopper materials with a product of lime (3% of weight), water, and fly ash. Major components of the hopper material and fly ash will be silicon, aluminum, and iron compounds (see coal ash analysis; Subsection 2.1.2.1), while the FGD slurry will be mainly calcium sulfate and calcium sulfite. A typical pozzolanic (cement-producing) reaction will occur when the lime, fly ash, and water are mixed:

$3\ CaO \cdot SiO_2 \cdot 3H_2O$

$3\ CaO \cdot Al_2O_3 \cdot 6H_2O$

Composition of the sludge will be:

$CaSO_4 \cdot 2H_2O$
$CaSO_3 \cdot 1/2\ H_2O$
$CaCO_3$

so that reaction with the intermediate products will produce cementitious sulfites or sulfates.

Lime consumption for this process for both units will average around 70 tons each day, or 26,000 tons per year. Delivery of lime (3/4-inch pebbles) will be by truck or rail and storage (60-day supply) will be in silos.

At maximum capacity, total stabilized waste generation from each unit will be 124 tons, or 4057 cubic feet per hour. Average annual production for both units will be 1.25 million tons, amounting to 28,900 acre-feet during the life of the project. Fresh stabilized waste will be stockpiled until cured. The cured waste will be trucked each day to one of the landfill areas shown in Figures 2.1-2 and 2.1-7. Capacities of each landfill area on the Hancock site, based on 494-feet clearance of Jeffry Cliff (an offsite landform), existing topography, and contouring of 40 to 45 feet maximum, will be:

	Acres	Acre-Feet	Generating Unit-Years
Landfill Area 1	169	7,300	17.7
Landfill Area 2	309	13,350	32.5
Landfill Area 3	191	8,250	20.0
TOTAL	669	28,900	70.2

The landfill areas will be cleared and leveled in 25-acre increments. The stablized waste will be contoured in valleys and lower slopes to the extent possible, topsoil will be added, and grasses seeded. Benching will be done as necessary and temporary drainage systems will discharge into a temporary retention basin. Once a fill increment has vegetated, natural drainage will establish and the basin will be reclaimed.

Landfill sequence for the Breckinridge site has not been determined but incremental development and reclamation would be similar.

Production of a stabilized waste for onsite disposal provides the least probability of contamination of groundwater and soils, as well as the most flexibility for future expansion of the plant (Table 2.1-14). The stabilization process is relatively new and leaching characteristics, although considered the least impactful, are basically unknown. Possible leachates and their potential leachability relative to onsite soils are discussed in Section 3.4.2.

Blended Waste. As in the stablized waste process, one system handles all of the solid wastes from the power plant. In this process, however, lime is omitted as a fixing agent and levels of soluble components in the solid blend remain higher than those in the stabilized solid blend. Thus, leachate formation is not minimized for landfill disposal (Table 2.1-14), and

Table 2.1-14 Comparison of Solid Waste Disposal Processes

Process	Advantages	Disadvantages
Stabilized Waste	All solid wastes handled in one system. Easily transported. Minimizes leachate potential. Landfill disposal allows other land use. Future markets possible.	Lime additive increases bulk and costs.
Blended Waste	All solid wastes handled in one system. Easily transported. Less bulk and expense than stabilized waste. Landfill land use may be more limited.	Leaching potential higher than stabilized waste. No markets.
Sale of Solid Waste	Proven use of ash wastes. Potential for use of sludge wastes.	Requires separate processing. Markets will not dispose of total U.S. production (about 15% of U.S. production since 1965 has been marketed). Synthetic gypsum process relatively unproven. Synthetic gypsum not readily marketable because of plentiful natural gypsum.
Ponding of Solid Wastes	Proven technology.	Large areas unreclaimable for several years. Generally requires lining to prevent or mitigate groundwater and other contamination. Most expensive disposal method.

Sources: Hecht and Duvall (1975); Duedall and Seligman (1979); Ansari and Owen (1980).

lining or other treatment could be necessary to prevent groundwater contamination and significant buildup of trace elements in soils and vegetation.

Sale of Solid Wastes. Current marketability of solid wastes requires separate processing of ash and sludge components. Bottom ash and pyrites are dewatered and sold with fly ash for roadbed material. The sludges are oxided to form gypsum, which is used in building materials. However, the market for road fill will not dispose of total U.S. production of fly ash and the synthetic gypsum process is still unproven (Table 2.1-14).

Ponding of Solid Wastes. This historic method of solid waste disposal pumps slurries, sludges, and dry wastes to holding ponds. The water may or may not be recycled. Filled ponds are covered with soil.

Ponded solid wastes are most susceptible to seepage and discharge of trace elements, although synthetic or clay liners are now generally used to prevent or mitigate impacts from seepage. Runoff generally is regulated by sizing the pond for sufficient freeboard and providing diversion canals to other impoundments. Overall, ponding results in the greatest waste volume and is the most expensive solid waste disposal method (Table 2.1-14).

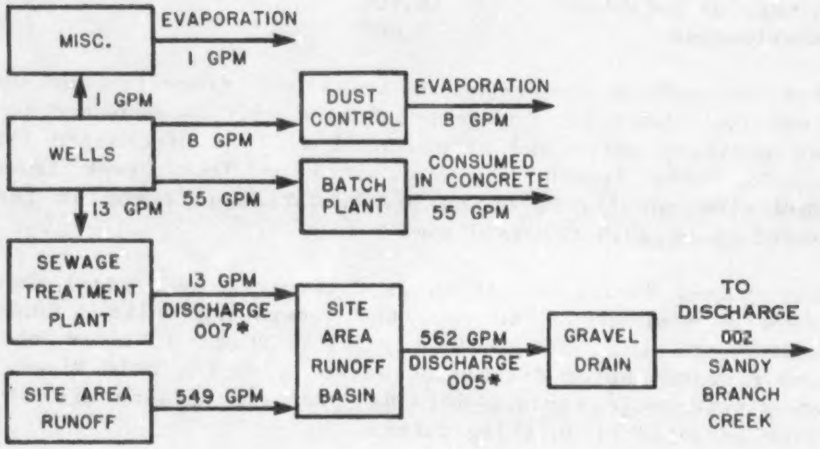
2.1.4.3 Water Use

2.1.4.3.1 Water Sources

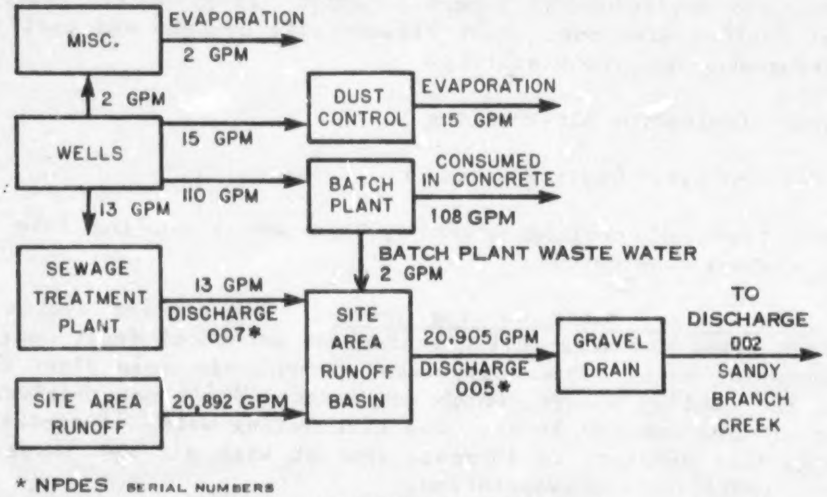
Water sources available to meet water demands of constructing and operating the Hancock Generating Station are groundwater and the Ohio River. Because the plant will require up to approximately 16,000 gallons per minute (gpm) makeup water to maintain a 560,232-gpm circulating cooling water flow and other flows after start-up, the Ohio River was considered the better source for the majority of operating water demands (cooling water). Proposed groundwater use for boiler makeup, potable, and service water consists of up to approximately 1000 gpm of the maximum operating demand and up to 140 gpm to supply all construction water demands. This amount of groundwater can be obtained from a minimum of onsite wells (average pumpage for the alluvial aquifer in the project area is 300 to 500 gpm), which can be installed and pumped economically from the alluvial aquifer. Were groundwater used to supply total operating needs (23 million gallons per day at maximum plant load), numerous onsite wells would be required, or an alternative would be installation of large Ranney wells in the bed of the Ohio River (see Alternative Intake Structures, Subsection 2.1.4.3.4). These are more costly than either onsite wells or equipment for Ohio River water withdrawal.

2.1.4.3.2 Water Demand and Flow

Maximum expected groundwater demand and continuous daily flow during construction will be (Figure 2.1-10):


MISC.
EVAPORATION
1 GPM
1 GPM
WELLS
DUST CONTROL
EVAPORATION
8 GPM
8 GPM
BATCH PLANT
CONSUMED IN CONCRETE
55 GPM
55 GPM
13 GPM
SEWAGE TREATMENT PLANT
13 GPM
DISCHARGE
007*
SITE AREA RUNOFF BASIN
562 GPM
DISCHARGE
005*
GRAVEL DRAIN
TO DISCHARGE
002
SANDY BRANCH CREEK
SITE AREA RUNOFF
549 GPM

ANNUAL AVERAGE FLOWS


MISC.
EVAPORATION
2 GPM
2 GPM
WELLS
DUST CONTROL
EVAPORATION
15 GPM
15 GPM
BATCH PLANT
CONSUMED IN CONCRETE
108 GPM
110 GPM
BATCH PLANT WASTE WATER
2 GPM
13 GPM
SEWAGE TREATMENT PLANT
13 GPM
DISCHARGE
007*
SITE AREA RUNOFF BASIN
20.905 GPM
DISCHARGE
005*
GRAVEL DRAIN
TO DISCHARGE
002
SANDY BRANCH CREEK
SITE AREA RUNOFF
20,892 GPM
* NPDES SERIAL NUMBERS

MAXIMUM FLOWS

SOURCE: Sargent & Lundy (1981)

Figure 2.1-10. Water Flow for Construction Activities, Hancock Generating Station Units 1 and 2

Use	Maximum Demand (gallons per day)	Maximum Flow (gallons per minute)
Dust control	22,000	15
Batch concrete	160,000	110
Sanitary or potable	18,700	13
Miscellaneous	3,000	2

Water sprayed on construction areas and miscellaneous water will evaporate primarily. Water for concrete batching will be consumed in the process. Treated sanitary water and site runoff will be discharged (NPDES discharge 002) into Sandy Branch (Hancock site) or Town Creek (Breckinridge site). Maximum site runoff, based on precipitation patterns in the project area, is expected to be 20.9 thousand gpm.

Water demand during operation is determined by several factors, including the type of system used to cool the generating units. Cooling water systems evaluated for the Hancock Generating Station included once-through cooling (once-circulated water discharged directly to the Ohio River) and several types of closed-cycle cooling methods that use outside air or water to remove heat from recycled circulating water.

KU proposes a closed-cycle wet mechanical draft cooling tower system rather than once-through cooling because the once-through system has a higher installed cost and environmental impact potential is greater. Choice of the wet mechnical draft system over other closed-cycle systems was partly because of proven performance and low visiblity.

2.1.4.3.3 Heat Dissipation Alternatives

2.1.4.3.3.1 Closed-cycle Cooling Water

Four types of cooling tower systems and a cooling lake were the closed-cycle systems considered.

Wet Mechanical Draft Cooling Towers. The cooling system proposed for the Hancock plant has a 12-cell circular wet mechnical draft cooling tower for each generating unit. Water circulated through the main plant condensers is cycled to the cooling towers, which use induced-draft motor-driven fans to draw outside air through the tower. The circulating water is continually redistributed in fine droplets to increase contact with air and loses its heat by convection, radiation and evaporation.

There are several advantages to a mechnical draft system. The tower is smaller than a natural draft tower because air movement is accomplished by fans rather than by a chimney effect, which means lower capital costs and lower visibility (Table 2.1-15). Fans also allow greater control over air supply and water temperatures. This control means high operating costs, with the fans requiring as much as 0.5% of the station's energy use.

Disadvantages of the proposed system include a visible plume that is produced by moisture-laden air coming in contact with cooler outside air. In this case, small size is not an advantage because potential plume-induced fogging and icing often is at ground level.

Table 2.1-15. Comparison of Cooling Water Systems

System	Advantages	Disadvantages
Closed-cycle Cooling		
Wet mechanical cooling towers	Low capital costs Low visibility Little impact on aquatic biota Control of air supply and water temperatures Performance independent of relative humidity	Potential localized fogging and icing High operation/maintenance costs
Wet natural draft cooling towers	Low operation/maintenance costs Little impact on aquatic biota Good plume dispersion qualities	Potential localized fogging and icing High visibility High capital costs Performance partially dependent on environmental conditions
Dry cooling towers	Little impact on aquatic biota No fogging or icing Low visibility	High capital costs High operation/maintenance High backpressures make them unsuitable for conventional turbines
Wet/dry cooling towers	Low visibility Can modify plume characteristics to limit fogging and icing Little impact on aquatic biota	High capital costs High operation/maintenance costs
Cooling lake	Potential for recreation Low operation/maintenance costs	Requires flooding of 1800 acres No available land for flooding
Once-through Cooling	None apparent	High construction impact Large impact on aquatic biota High capital costs

Sources: Koflat (1974); Haggerty and LeFevre (1976); Rubin and Klanian (1975).

The proposed cooling system will be operated to minimize both makeup demand (consumptive use of Ohio River water) and discharge from the cooling tower cold-side blowdown (water with concentrated dissolved and suspended materials) to the river. Estimated demands and continuous daily flows for the cooling water system and other water systems are shown in Figure 2.1-11 and Table 2.1-16.

The cooling water system estimates are based on 6.8 cycles of concentration (condenser to cooling tower to condenser loops). Increased cycles of concentration would decrease makeup water, makeup pump power, water pretreatment, and blowdown discharge flow. However, at 2.9 cycles of concentration and above, Ohio River water at the sites requires sulfuric acid treatment to prevent calcium carbonate ($CaCO_3$) sealing and deterioration of pipes and heat transfer surfaces. It is estimated that the reaction product, calcium sulfate, could be a problem at above 6.8 cycles of concentration in the event of above average $CaCO_3$ levels and above average circulating water temperatures. Average $CaCO_3$ content and average circulating water temperature will allow up to 10.4 cycles of concentration. For optimum operating conditions a continuous monitor will determine total dissolved solids (an indicator of $CaCO_3$ content) and temperature of circulating water.

The impacts of this system on Ohio River water availability will be insignificant (see Section 3.4.1) under any of the projected operating conditions. Impacts on groundwater availability in the project area also will be insignificant (see Section 3.4.2).

Wet Natural Draft Cooling Towers. Relying on an upward draft created by the density difference in warm air inside the tower and cooler air outside, the natural draft tower works on the same principle of heat transfer but is 300 to 500 feet tall. Aesthetic impact may be large (Table 2.1-15). However, in one evaluation under worst-case meteorological conditions, viewers criticized the lower mechanical draft towers where topography and vegetation obscured them because the sources of the intense plume were not visible, producing the appearance of ground fire. Construction cost is about 3 times that of a mechanical draft type.

Dry Cooling Towers. Because they dissipate heat by conduction, convection, and radiation in a system of fine tubes similar to an auto radiator, dry cooling towers are more of a closed system than are wet ones, and have no plume (Table 2.1-15). They not only require considerable maintenance, but also require more capital cost to build. In addition, the high condenser backpressures make them unsuitable for use with conventional turbines.

Wet/Dry Cooling Towers. These towers can operate in an all wet or mostly dry mode when weather conditions permit. This reduces evaporation, and plume visibility can be controlled by varying the wet to dry tower use ratio. These towers are costly and have maintenance problems associated with both systems (Table 2.1-15).

Cooling Lake. This system uses impounded water as the circulating water source, passing withdrawn water through the condenser and returning it. Artificially-induced currents are created, retaining heated water and allowing

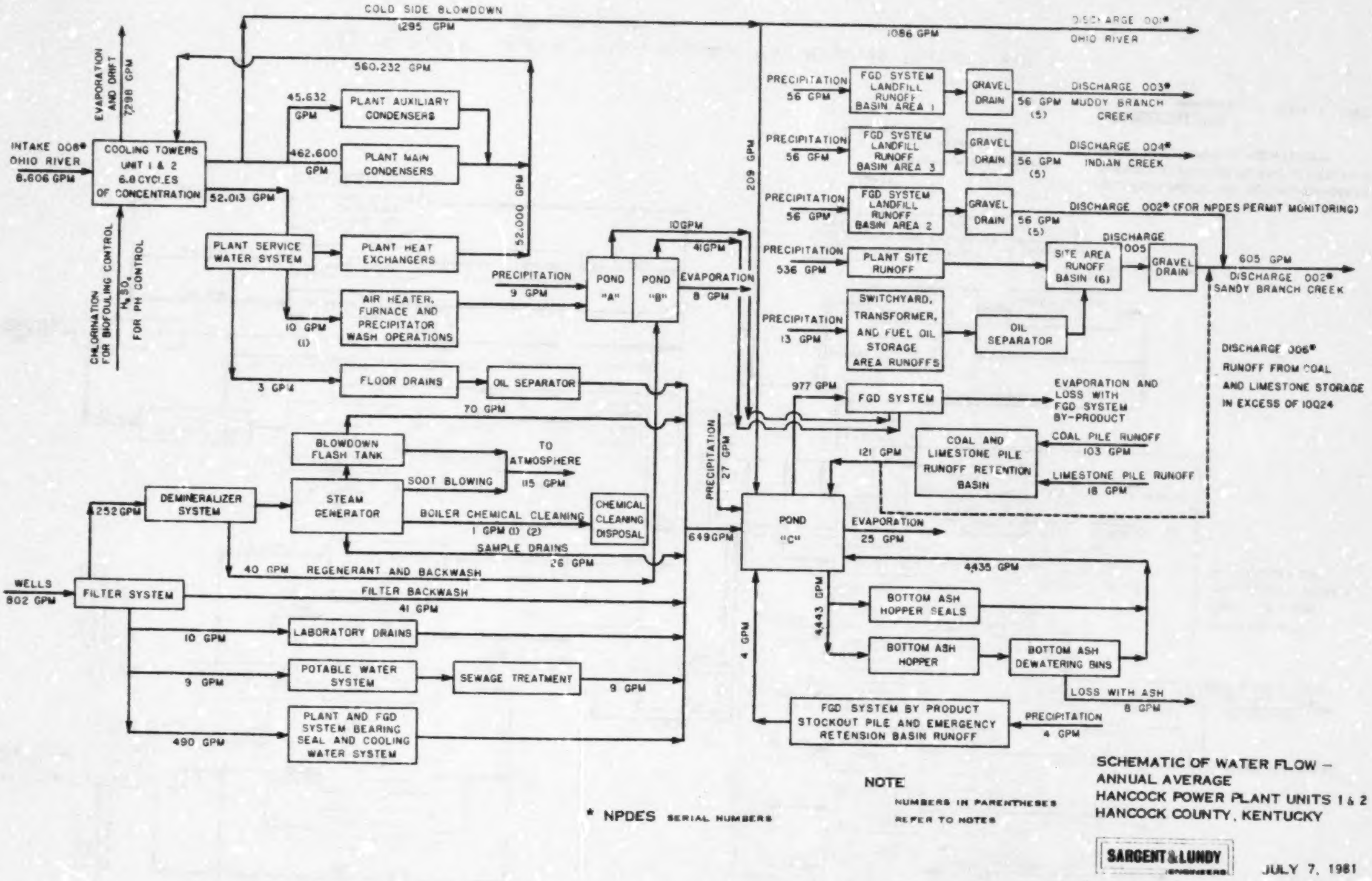

INTAKE 008*
OHIO RIVER
8,606 GPM
EVAPORATION AND DRIFT
7298 GPM
CHLORINATION FOR BIOFOULING CONTROL
H_2SO_4 FOR PH CONTROL
COOLING TOWERS UNIT 1 & 2 6.8 CYCLES OF CONCENTRATION
COLD SIDE BLOWDOWN
1295 GPM
560,232 GPM
45,632 GPM
PLANT AUXILIARY CONDENSERS
462,600 GPM
PLANT MAIN CONDENSERS
52,013 GPM
52,000 GPM
PLANT SERVICE WATER SYSTEM
PLANT HEAT EXCHANGERS
10 GPM (1)
AIR HEATER, FURNACE AND PRECIPITATOR WASH OPERATIONS
3 GPM
FLOOR DRAINS
OIL SEPARATOR
70 GPM
BLOWDOWN FLASH TANK
TO ATMOSPHERE
115 GPM
SOOT BLOWING
252 GPM
DEMINERALIZER SYSTEM
STEAM GENERATOR
BOILER CHEMICAL CLEANING
1 GPM (1) (2)
CHEMICAL CLEANING DISPOSAL
SAMPLE DRAINS
26 GPM
40 GPM
REGENERANT AND BACKWASH
WELLS
802 GPM
FILTER SYSTEM
FILTER BACKWASH
41 GPM
10 GPM
LABORATORY DRAINS
9 GPM
POTABLE WATER SYSTEM
SEWAGE TREATMENT
9 GPM
490 GPM
PLANT AND FGD SYSTEM BEARING SEAL AND COOLING WATER SYSTEM
PRECIPITATION
9 GPM
POND "A"
POND "B"
10GPM
41GPM
EVAPORATION
8 GPM
PRECIPITATION
27 GPM
649GPM
209 GPM
1086 GPM
DISCHARGE 001*
OHIO RIVER
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 1
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 003*
MUDDY BRANCH CREEK
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 3
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 004*
INDIAN CREEK
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 2
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 002* (FOR NPDES PERMIT MONITORING)
PRECIPITATION
536 GPM
PLANT SITE RUNOFF
SITE AREA RUNOFF BASIN (6)
DISCHARGE 005
GRAVEL DRAIN
605 GPM
DISCHARGE 002*
SANDY BRANCH CREEK
PRECIPITATION
13 GPM
SWITCHYARD, TRANSFORMER, AND FUEL OIL STORAGE AREA RUNOFFS
OIL SEPARATOR
DISCHARGE 006*
RUNOFF FROM COAL AND LIMESTONE STORAGE IN EXCESS OF 10Q24
977 GPM
FGD SYSTEM
EVAPORATION AND LOSS WITH FGD SYSTEM BY-PRODUCT
121 GPM
COAL AND LIMESTONE PILE RUNOFF RETENTION BASIN
COAL PILE RUNOFF
103 GPM
LIMESTONE PILE RUNOFF
18 GPM
POND "C"
EVAPORATION
25 GPM
4435 GPM
4443 GPM
BOTTOM ASH HOPPER SEALS
BOTTOM ASH HOPPER
BOTTOM ASH DEWATERING BINS
LOSS WITH ASH
8 GPM
4 GPM
FGD SYSTEM BY PRODUCT STOCKOUT PILE AND EMERGENCY RETENSION BASIN RUNOFF
PRECIPITATION
4 GPM
* NPDES SERIAL NUMBERS
NOTE
NUMBERS IN PARENTHESES REFER TO NOTES
SCHEMATIC OF WATER FLOW –
ANNUAL AVERAGE
HANCOCK POWER PLANT UNITS 1 & 2
HANCOCK COUNTY, KENTUCKY
SARGENT & LUNDY ENGINEERS
JULY 7, 1981

Figure 2.1-11 Water Flow Schematic for Hancock Units 1 and 2
(Sheet 1 of 3)

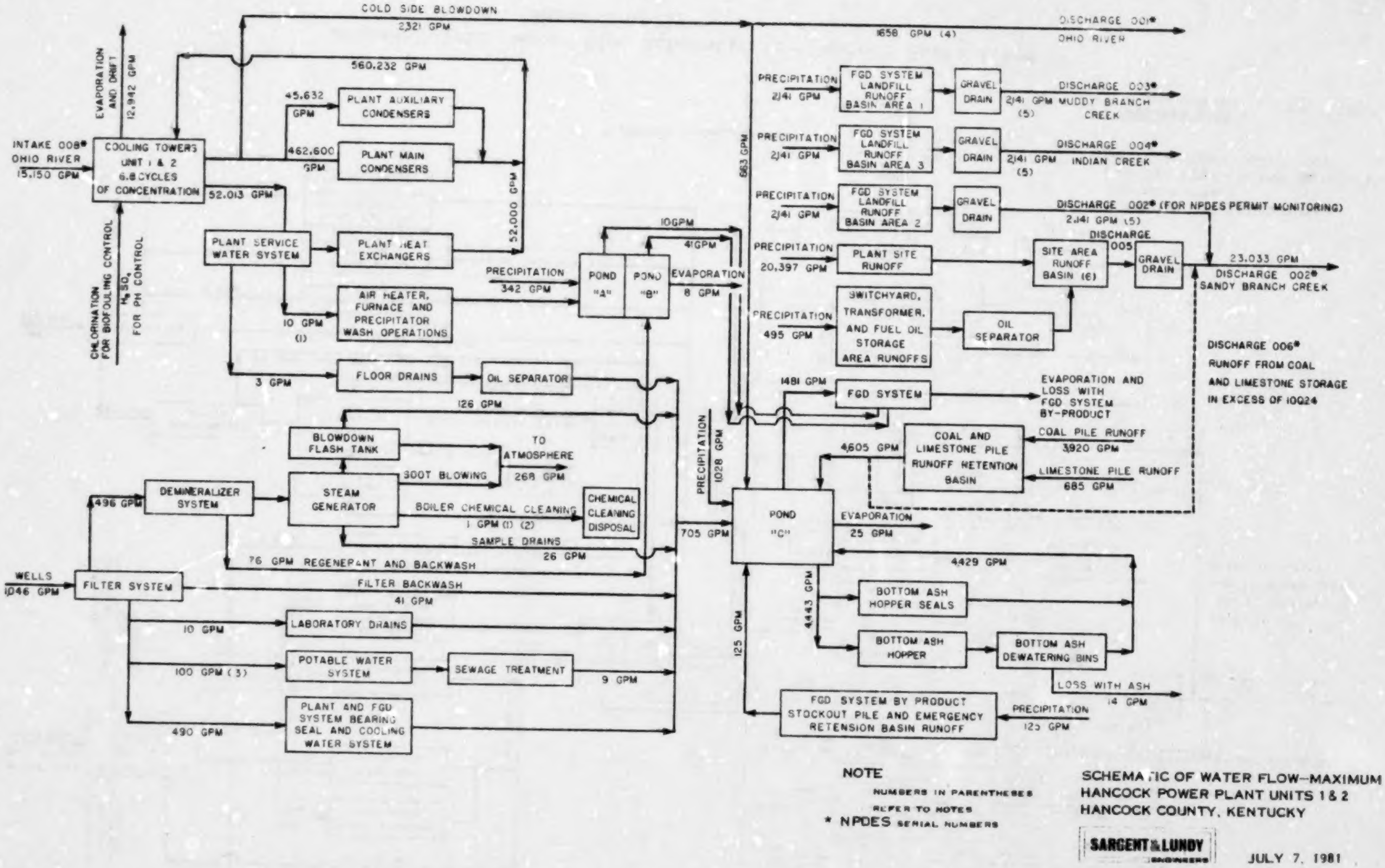

INTAKE 008*
OHIO RIVER
15,150 GPM
EVAPORATION AND DRIFT
12,942 GPM
COOLING TOWERS UNIT 1 & 2 6.8 CYCLES OF CONCENTRATION
CHLORINATION FOR BIOFOULING CONTROL
H_2SO_4 FOR PH CONTROL
COLD SIDE BLOWDOWN
2321 GPM
560,232 GPM
45,632 GPM
PLANT AUXILIARY CONDENSERS
462,600 GPM
PLANT MAIN CONDENSERS
52,013 GPM
52,000 GPM
PLANT SERVICE WATER SYSTEM
PLANT HEAT EXCHANGERS
AIR HEATER, FURNACE AND PRECIPITATOR WASH OPERATIONS
10 GPM (1)
3 GPM
FLOOR DRAINS
OIL SEPARATOR
126 GPM
PRECIPITATION
342 GPM
POND "A"
POND "B"
10GPM
41GPM
EVAPORATION
8 GPM
BLOWDOWN FLASH TANK
TO ATMOSPHERE
268 GPM
SOOT BLOWING
STEAM GENERATOR
BOILER CHEMICAL CLEANING
1 GPM (1) (2)
CHEMICAL CLEANING DISPOSAL
SAMPLE DRAINS
26 GPM
DEMINERALIZER SYSTEM
496 GPM
76 GPM REGENERANT AND BACKWASH
WELLS
1046 GPM
FILTER SYSTEM
FILTER BACKWASH
41 GPM
10 GPM
LABORATORY DRAINS
100 GPM (3)
POTABLE WATER SYSTEM
SEWAGE TREATMENT
9 GPM
490 GPM
PLANT AND FGD SYSTEM BEARING SEAL AND COOLING WATER SYSTEM
705 GPM
PRECIPITATION
1028 GPM
663 GPM
1658 GPM (4)
DISCHARGE 001*
OHIO RIVER
PRECIPITATION
2141 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 1
GRAVEL DRAIN
2141 GPM (5)
DISCHARGE 003* MUDDY BRANCH CREEK
PRECIPITATION
2141 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 3
GRAVEL DRAIN
2141 GPM (5)
DISCHARGE 004* INDIAN CREEK
PRECIPITATION
2141 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 2
GRAVEL DRAIN
DISCHARGE 002* (FOR NPDES PERMIT MONITORING)
2141 GPM (5)
PRECIPITATION
20,397 GPM
PLANT SITE RUNOFF
SITE AREA RUNOFF BASIN (6)
DISCHARGE 005
GRAVEL DRAIN
23,033 GPM
DISCHARGE 002*
SANDY BRANCH CREEK
PRECIPITATION
495 GPM
SWITCHYARD, TRANSFORMER, AND FUEL OIL STORAGE AREA RUNOFFS
OIL SEPARATOR
DISCHARGE 006*
RUNOFF FROM COAL
AND LIMESTONE STORAGE
IN EXCESS OF 10Q24
1481 GPM
FGD SYSTEM
EVAPORATION AND LOSS WITH FGD SYSTEM BY-PRODUCT
4605 GPM
COAL AND LIMESTONE PILE RUNOFF RETENTION BASIN
COAL PILE RUNOFF
3920 GPM
LIMESTONE PILE RUNOFF
685 GPM
POND "C"
EVAPORATION
25 GPM
4429 GPM
4443 GPM
BOTTOM ASH HOPPER SEALS
BOTTOM ASH HOPPER
BOTTOM ASH DEWATERING BINS
LOSS WITH ASH
14 GPM
125 GPM
FGD SYSTEM BY PRODUCT STOCKOUT PILE AND EMERGENCY RETENSION BASIN RUNOFF
PRECIPITATION
125 GPM
NOTE
NUMBERS IN PARENTHESES REFER TO NOTES
* NPDES SERIAL NUMBERS
SCHEMATIC OF WATER FLOW–MAXIMUM
HANCOCK POWER PLANT UNITS 1 & 2
HANCOCK COUNTY, KENTUCKY
SARGENT & LUNDY ENGINEERS
JULY 7, 1981

Figure 2.1-11 Water Flow Schematic for Hancock Units 1 and 2
(Sheet 2 of 3)

Water Use Diagram

Notes:

1) The air heater and precipitator wash and boiler cleaning flows noted represents the average impact of these infrequent water uses.

2) Boiler chemical cleaning wastes will be disposed of by evaporation in the steam generator (orgainc acids) and application to on-site fields (phosphates). If chemical cleaning procedures do not allow the above disposal methods, the wastes will be hauled off-site and disposed of by a licensed contractor.

3) Domestic water use flows shown on the maximum flow diagram represent maximum instantaneous flows. The effluent flow rate from the sewage treatment plant is controlled.

4) During upset conditions when make-up water to Pond C is not required, the maximum discharge rate (maximum flow diagram) would be increased by 613 gpm.

5) Only approximately 25 acres of the FGD System by-product landfill area will be active at any one time.

6) Site area runoff basin is installed for use during construction and will remain in place for normal plant operation.

7) Precipitation flows on the maximum diagram are based on maximum once in ten years 24 hour rainfall rates.

8) Ponds A, B, and C will be sized for some retention. Therefore, flows noted on the maximum diagram, in and out of these ponds, do not necessarily balance.

SOURCE: Sargent & Lundy (1980)

Figure 2.1-11 Water Flow Schematic for Hancock Units 1 and 2 (Sheet 3 of 3)

Table 2.1-16 Water Flow and Use for Operating Hancock Generating Station Units 1 and 2

Operation	Maximum Flow (gpm)	Average Flow (gpm)
Cooling Water		
Auxiliary condensers	45,632	
Main condensers	462,600	
Heat exchangers	52,000	
Equipment wash	10	
Floor wash	3	
Evaporation	12,942	7,298
Cold-side blowdown	2,321	1,295
Makeup (Ohio River)	15,150	8,606
Filtered Water		
Filter backwash	41	
Boiler feedwater	296	252
Laboratory drains	10	
Potable	9(100)(max. instantaneous)	9
Service water	490	
Evaporation	268	115
Makeup (groundwater)	1,046	802
Ponds A and B Cycle		
Evaporation	8 (A + B)	
FGD System	10 (A) 40 (B)	76 (B)
Makeup		
Precipitation	342 (A + B)	
Cooling water system	10 (A)	
Filtered water system	40 (B)	76 (B)
Pond C Cycle		
FGD system	1,481	977
Bottom ash handling	4,443 (4,429 circulating)	4,443 (4,435 circulating)
Evaporation and loss	25	25
Makeup		
Cold-side blowdown	663	209
Filtered water system	702	646
Floor wash	3	
Stabilized waste stockout pile	125	4
Coal and limestone pile	4,605	121
Precipitation	1,028	27
Discharge		
Ohio River	1,658	1,086
Muddy Branch	2,141	56
Sandy Branch	23,033	605
Indian Creek	2,141	56

Source: Kentucky Utilities Company (1981).

sufficient cooling (radiation and evaporation) for reuse. An 1800-acre impoundment would be necessary for the Hancock Station's two units (Table 2.1-15).

2.1.4.3.3.2 Once-through Cooling

In this system, the Ohio River would be used as a heat sink. Water is withdrawn, circulated through the condenser, and returned downstream of the intake structure. This system would require 650,000 gpm for the 2-unit Hancock plant. The addition of heat would disturb thermal equilibrium until the heat is dissipated because a natural water body tends to maintain a heat balance with the atmosphere.

Once-through cooling was rejected as an alternative heat dissipation system because of several adverse environmental effects, including the thermal discharge. Potential thermal-induced impacts include modification of phytoplankton and zooplankton abundance and composition, modification of local movement and congregation of fish, modification of the reproductive capacities of fish, and alterations in the distributions of benthic organisms.

Construction of a once-through system requires substantial quantities of large pipes, a large intake structure, and a discharge structure on the shore. Permanent impacts may occur from construction of the intake system.

Impingement and entrainment of aquatic biota are major impacts because of the volume of intake water and its velocity. Those intakes minimizing impacts are costly. All capital costs of the once-through system are high (Table 2.1-15).

2.1.4.3.4 Water Intake and Discharge Structures

2.1.4 3.4.1 Ohio River

Intake equipment proposed for the Hancock plant includes three makeup pumps to be housed in a 35-foot-diameter concrete structure above the 100-year flood level on the shore at Ohio RM 716 (Hancock site) or RM 705.5 (Breckinridge site). Capacity of each pump will be 8000 gpm, so that one can act as a spare during all operational loads. Two buried 42-inch-diameter makeup pipelines will carry river water to the cooling towers. The cold-side blowdown will be discharged through a 24-inch-diameter pipeline that parallels the makeup pipelines to near the shoreline; from the shoreline it will extend 38 feet into the river at a depth of 6 feet (Figure 2.1-12 shows Hancock site detail).

The two intake pipes will be buried from the cooling towers into the Ohio River riverbed to distances of 340 and 640 feet from the pumphouse, respectively (Figure 2.1-12). Each will emerge and fork near its end for attachment to two intake screens. Underwater position of each pair of screens will be 360 feet msl, which is 22 feet below normal surface elevation maintained by the Cannelton Lock and Dam. The screens will be cyclinders 13 feet long and 4 feet in diameter. Screen openings will be spaced at 0.25 inches, so that openings will be less than that. The longitudinal centerline of each screen will parallel river flow. At the proposed depth, the screens should remain slightly submerged should lock and dam failure occur.

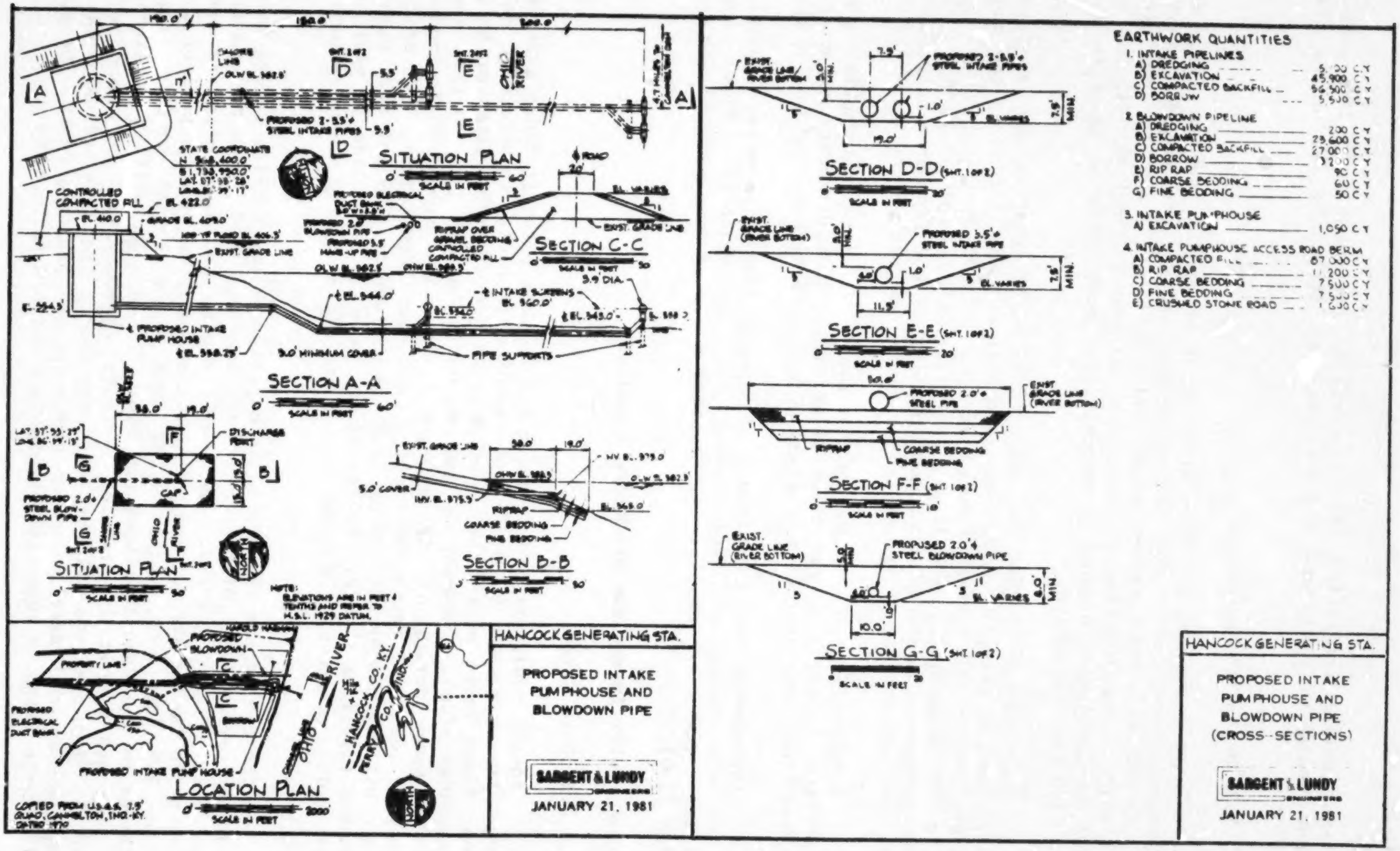

SITUATION PLAN
SCALE IN FEET
SHORE LINE
OLW EL. 382.8'
PROPOSED 2-5.5'ø STEEL INTAKE PIPES
STATE COORDINATE
OHIO RIVER
SECTION A-A
CONTROLLED COMPACTED FILL
EL. 422.0'
EL. 410.0'
GRADE EL. 409.0'
100-YR FLOOD EL. 406.5'
EXIST. GRADE LINE
PROPOSED INTAKE PUMP HOUSE
3.0' MINIMUM COVER
PIPE SUPPORTS
INTAKE SCREENS EL. 360.0'
3.9' DIA.
SECTION C-C
PROPOSED ELECTRICAL DUCT BANK
PROPOSED 2.0' BLOWDOWN PIPE
PROPOSED 5.5' MAKE-UP PIPE
RIPRAP OVER GRAVEL BEDDING
CONTROLLED COMPACTED FILL
EXIST. GRADE LINE
DISCHARGE PORT
PROPOSED 2.0'ø STEEL BLOWDOWN PIPE
CAP
SITUATION PLAN
SECTION B-B
RIPRAP
COARSE BEDDING
FINE BEDDING
5.0' COVER
NOTE: ELEVATIONS ARE IN FEET & TENTHS AND REFER TO M.S.L. 1929 DATUM.
LOCATION PLAN
PROPERTY LINE
PROPOSED BLOWDOWN
PROPOSED ELECTRICAL DUCT BANK
PROPOSED INTAKE PUMP HOUSE
OHIO RIVER
HANCOCK CO. KY.
PERRY CO. IND.
NORTH
COPIED FROM U.S.G.S. 7.5' QUAD, CANNELTON, IND.-KY. PHOTO 1970
HANCOCK GENERATING STA.
PROPOSED INTAKE PUMPHOUSE AND BLOWDOWN PIPE
SARGENT & LUNDY ENGINEERS
JANUARY 21, 1981
SECTION D-D (SHT. 1 OF 2)
PROPOSED 2-5.5'ø STEEL INTAKE PIPES
EXIST. GRADE LINE (RIVER BOTTOM)
EL. VARIES
SECTION E-E (SHT. 1 OF 2)
PROPOSED 5.5'ø STEEL INTAKE PIPE
SECTION F-F (SHT. 1 OF 2)
PROPOSED 2.0'ø STEEL PIPE
RIPRAP
COARSE BEDDING
FINE BEDDING
SECTION G-G (SHT. 1 OF 2)
PROPOSED 2.0'ø STEEL BLOWDOWN PIPE
EARTHWORK QUANTITIES
1. INTAKE PIPELINES
A) DREDGING 5,100 C.Y.
B) EXCAVATION 45,900 C.Y.
C) COMPACTED BACKFILL 56,500 C.Y.
D) BORROW 5,500 C.Y.
2. BLOWDOWN PIPELINE
A) DREDGING 200 C.Y.
B) EXCAVATION 23,600 C.Y.
C) COMPACTED BACKFILL 27,000 C.Y.
D) BORROW 3,200 C.Y.
E) RIP RAP 90 C.Y.
F) COARSE BEDDING 60 C.Y.
G) FINE BEDDING 50 C.Y.
3. INTAKE PUMPHOUSE
A) EXCAVATION 1,050 C.Y.
4. INTAKE PUMPHOUSE ACCESS ROAD BERM
A) COMPACTED FILL 67,000 C.Y.
B) RIP RAP 11,200 C.Y.
C) COARSE BEDDING 7,500 C.Y.
D) FINE BEDDING 7,500 C.Y.
E) CRUSHED STONE ROAD 1,600 C.Y.
HANCOCK GENERATING STA.
PROPOSED INTAKE PUMPHOUSE AND BLOWDOWN PIPE (CROSS-SECTIONS)
SARGENT & LUNDY ENGINEERS
JANUARY 21, 1981

Figure 2.1-12 Proposed Intake and Blowdown Water Systems in the Ohio River for Hancock Units 1 and 2

Three types of intake systems were evaluated: onshore traveling screens, Ranney wells, and the offshore slotted screens proposed for the plant.

Offshore Slotted Screens. The slotted screen alternative will disturb aquatic communities during installation of the river structures and disrupt terrestrial communities during construction of the onshore pump structure. The area of terrestrial disturbance of construction activities would be approximately the same as the area disturbed by construction of an onshore traveling screen intake structure but less than that of Ranney wells.

This offshore intake structure is not anticipated to require the periodic maintenance dredging usually required for onshore traveling screens. Intake velocity will be the same, 0.5 feet per second or less, but water depth would differ. The cylindrical shape of the slotted screen offers minimum resistance to natural water flow. Particulate matter is not trapped against the screen face and buildup of deposits is minimized. This arrangement along with the low intake velocity should minimize entrainment and impingement.

A comparative summary of degree of expected ecological effects shows the offshore slotted screen to be environmentally acceptable:

Impact From	Onshore Traveling Screens	Ranney Wells	Offshore Slotted Screens
Construction	Desirable	Less Desirable	Desirable
Maintenance	Less Desirable	Most Desirable	Most Desirable
Entrainment	Less Desirable	Most Desirable	Desirable
Impingement	Desirable	Most Desirable	Most Desirable
Cost	Desirable	Less Desirable	Desirable

Definitions

Most Desirable:	Expected to have minimal adverse impact on aquatic and terrestrial biological communities; relative overall costs less than other alternatives.
Desirable:	May have impacts on aquatic and terrestrial communities that are more than minimal but not chronic or severe; costs generally in a range that is considered appropriate for the purpose of the structure.
Less Desirable:	May have severe and/or chronic impacts on aquatic and terrestrial communities. Costs exceed appropriate levels of expenditures relative to purpose of structure.

In conjunction with issuance of the NPDES permit and subsequent approval to begin operation of the proposed power plant under the permit, EPA must evaluate the adverse impact of cooling water intake structures on the aquatic environment. The provision for this evaluation is Section 316(b) of the Clean Water Act of 1977, which requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse impacts. These factors are addressed relative to the proposed system and site specific conditions in Section 3.4.1.

Onshore Traveling Screens. A conventional onshore intake structure usually consists of traveling screens that strain small debris from the cooling water. Trash racks generally are located in front of the traveling screens and these racks prevent large debris from collecting on the traveling screens. Construction of onshore traveling screen systems generally has an impact on terrestrial biota because of earthmoving activities, and on aquatic communities because of dredging activities.

If the onshore traveling screen structure is located in a shallow water area, periodic dredging of silt from in front of the structure may be required to maintain proper flow volume. Such activity would disrupt the biological communities in the immediate area. Intake approach velocity would be 0.5 feet per second or less, so that, although fish impingement would occur, it would be minimal.

Ranney Wells. A Ranney well type intake system consists of a cylindrical caisson approximately 16 to 18 feet in diameter with screen pipes projected into the aquifer below the river bed. This type of system is preferable to an onshore traveling screen since periodic maintenance dredging is not required because of the filtration effect on the aquifer. Entrainment of fish eggs and larvae and impingement of adult and juvenile fish will not occur using groundwater as a source for cooling water. At least three Ranney wells would be required to supply water for Hancock Units 1 and 2, and these wells would have to be spaced at least 1000 feet apart. The terrestrial area disturbed by construction of this number of wells would be greater than the area disturbed by construction of the other alternatives. In addition, the cost of the Ranney well type intake system would be several times greater than that of the other alternatives.

2.1.4.3.4.2 Wells

Locations and specifications of onsite wells for proposed groundwater withdrawal will be determined upon completion of onsite borings and water sample analyses. Preliminary data indicate that water of sufficient quantity and quality can be obtained from the alluvial aquifer. KU's demand on the alluvial aquifer is expected to have no significant impact on municipal, industrial, or domestic supplies (see Section 3.4.2)

2.1.4.3.5 Water Management

Proposed water management for the generating station was developed to meet water quality standards, minimize environmental impact, and maintain reasonable installation and operating costs. Water treatment processes proposed for the Hancock plant include pretreatments to make river and well water suitable for plant use, as well as treatments to make wastewater suitable for recycling in the closed water systems and to assure discharged water complies with water quality standards. The only discharges into surface waters during plant operation will be cooling tower blowdown, as mentioned, and site runoff, which includes runoff from the areas developed for plant facilities and from landfill areas for solid waste disposal (Water Flow Diagram, Figure 2.1-11;

discharge numbers are serial numbers of the draft NPDES permit appendixed to this report). Sewage treatment plant water will be temporarily discharged into an onsite stream during construction (Figure 2.1-10). Sewage treatment plant water and plant process water will be recycled in closed systems during operation and there will be no discharge of these wastestreams to waters of the United States (Figure 2.1-11).

2.1.4.3.5.1 Makeup Water Pretreatment

Circulating Water. As mentioned, makeup water from the Ohio River will be treated with sulfuric acid to control pH of the circulating water and prevent $CaCO_3$ effects on equipment. Additionally, chlorine will be added to the circulating water to prevent biofouling (mold and algae buildup) of the equipment. Quantities of both substances will be controlled so that blowdown water will meet effluent standards (Table 2.1-17).

Boiler Makeup, Potable and Service Water. At the desired flow rate, the expected high iron content of groundwater on the Hancock and Breckinridge sites will require a green sand filter system. The filter system will be backwashed periodically to remove accumulated solids. Neither the backwash water nor the potable and FGD system service water will be treated beyond the filter system. The remainder of the well water flow will be directed from the filter system to a demineralizer system to remove anions and cations prior to use for boiler makeup (Figure 2.1-11).

The precise demineralizer specifications will be based on results of a preliminary groundwater sampling program at the site. Maximum occurrence data from United States Geological Survey (USGS) indicate need for one weak acid cation vessel, one strong acid cation vessel, one vacuum degasifier (decarbonator), one strong base anion vessel, and one mixed bed vessel. From the mixed bed vessel, the water will go to storage. Regeneration of the cation resin with sulfuric acid and the anion resin with sodium hydroxide will occur every 24 hours.

2.1.4.3.5.2 Wastewater and Runoff Treatment

Wastewater management will include storage in holding Ponds A and B for use as a direct makeup water source for the FGD system and storage and recirculation in Pond C. Locations of the holding ponds are shown in Figures 2.1-2 (Hancock site) and 2.1-7 (Breckinridge site). Runoff treatment will utilize several retention basins, including 2 permanent ones - the coal and limestone pile runoff basin and the site area runoff basin (Figure 2.1-11) - and temporary ones to be constructed in active landfill areas (represented by gravel drains in Figure 2.1-11).

Holding Ponds. Design for Ponds A, B, and C will include discharge systems that will allow control of water levels between high and low set points. The high level set point will consider upset conditions (e.g., low makeup flows to the FGD system with maximum anticipated runoff rates). Each pond will be designed to contain a once-in-10-year 24-hour rainfall above the high set point (Figure 2.1-13). They will have a minimum 2-foot thick clay lining to effect a 10^{-7}-centimeter per second permeability or equivalent.

Table 2.1-17. Original and Proposed Revised Effluent Standards for New Sources Applicable to new Electric Power Generating Units

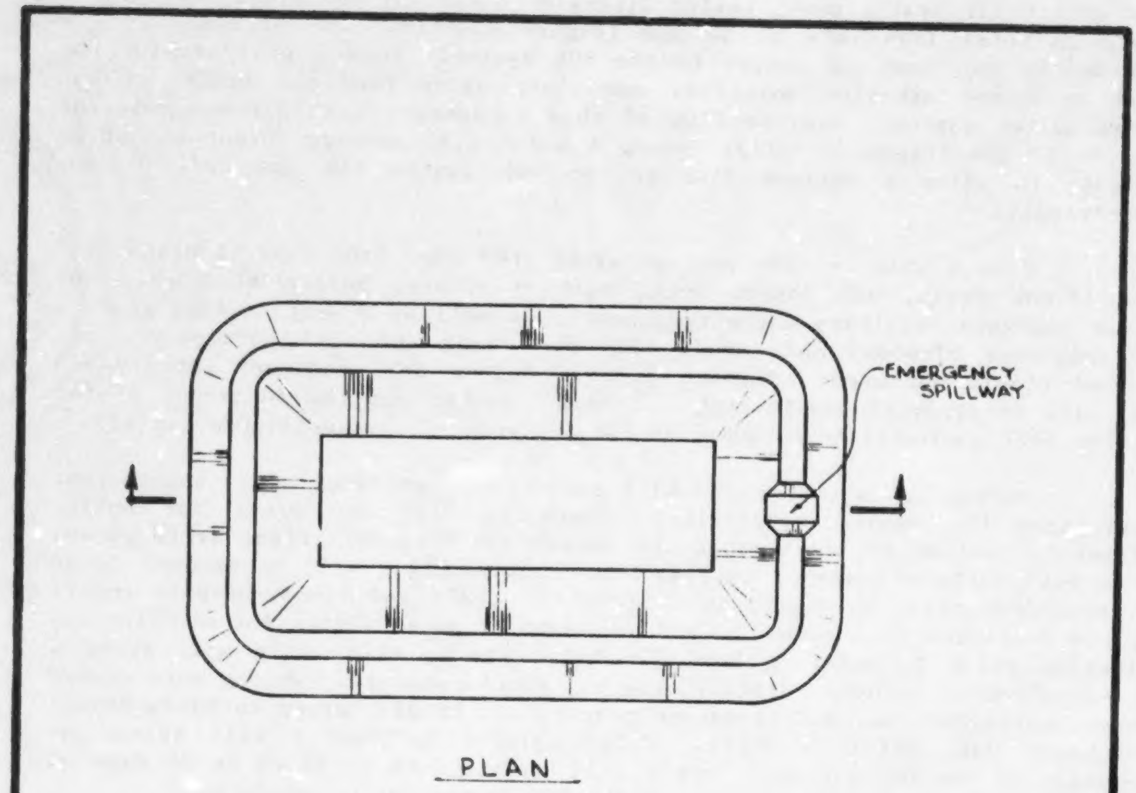
Effluent	Original NSSP (mg/liter x flow) Daily Maximum	Original NSSP (mg/liter x flow) Daily Average	Proposed Revised NSSP* (mg/liter x flow) Daily Maximum	Proposed Revised NSSP* (mg/liter x flow) Daily Average	NPDES Discharge Number (Figure 2.1-11)
All discharges					
Allowable pH range: 6.0 to 9.0					001,002,003,004
Polychlorinated biphenyl compounds	0	0	0	0	Not applicable
Low-volume wastes					Not applicable
Oil and grease	20.0	15.0	20.0	15.0	
Total suspended solids	100.0	30.0	100.0	30.0	
Bottom ash transport water					Not applicable
Oil and grease	1.00**	0.75**	20.0	15.0	
Total suspended solids	5.00**	1.50**	100.0	30.0	
Fly ash transport water					Not applicable
Oil and grease					
Total suspended solids	0	0	0	0	
Boiler blowdown (metal cleaning wastes)			Regulated as low-volume waste		Not applicable
Oil and grease	20.0	15.0			
Total suspended solids	100.0	30.0			
Copper (total)	1.0	1.0			
Iron (total)	1.0	1.0			
Cooling tower blowdown					001
Chlorine (free)***	0.5	0.2	-	-	
Chlorine (total)***	-	-	0.14	0.14	
Chromium	No detectable amount		No discharge		
Phosphorus	No detectable amount		No discharge		
Zinc	No detectable amount		No discharge		
Other corrosion inhibitors	No detectable amount		No discharge		
129 Priority pollutants	Not applicable		No discharge		
Once-through water					Not applicable
Chlorine (free)	0.5	0.2	No discharge		
	Maximum Instantaneous		Maximum Instantaneous		
Coal Pile Runoff					
Total suspended solids	50 (bypass without limitation 10Q24)		50 (bypass without limitation 10Q24)		006
Construction Runoff					
Total suspended solids	50 (remanded)		50 (remanded)		005

---

[*] Revised New Source Standards of Performance (NSSP) were proposed on October 14, 1980. New units must meet NSSP when they begin discharging. New units that commenced construction between March 4, 1974, and October 14, 1980, must meet the original NSSP when they begin discharging, and they cannot have more stringent NSSP requirements imposed on them for 10 years from the date of initial operation. New units that commenced construction after October 14, 1980, must meet the revised NSSP (when finalized) when they begin discharging. Final revised NSSP are expected in mid 1981.

[**] Maximum and average limitations apply to discharges from once-through systems.

[***] Maximum is maximum instantaneous; average is over chlorination time, not to exceed 2 hours.


EMERGENCY SPILLWAY
PLAN
2'-0" MIN. THICK CLAY LINING (10-7 CM/SEC PERMEABILITY) OR EQUIVALENT
HIGH SET PT. ELEV.
10 YEAR - 24 HOUR RAINFALL PLUS 1'
SECTION

SOURCE: Sargent & Lundy (1981)

Figure 2.1-13 Typical Detail for Ponds A, B, and C, Hancock Generating Station

Pond A will receive waste streams from infrequent (annual) cleaning processes - air heater wash, boiler fire-side cleaning, and precipitator wash - with a total flow rate of 10 gpm (Figure 2.1-11). The streams will be retained in the pond and pumped to the FGD system. Pond B will receive the spent acid and alkaline solutions and rinse water from the boiler makeup demineralizer system. Average flow of this regenerate and backwash material will be 40 gpm (Figure 2.1-11). Ponds A and B will provide holdup and surge capacity to allow a uniform flow to the FGD system (10 gpm and 40 gpm, respectively).

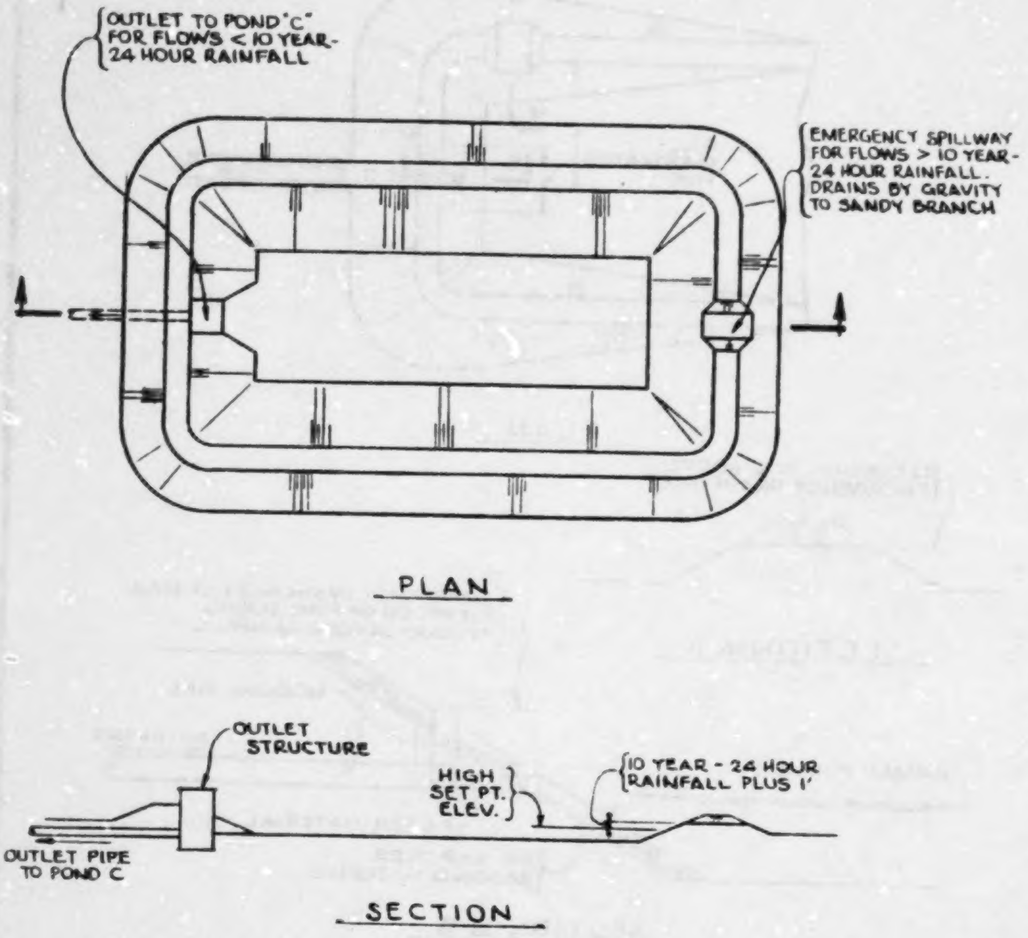
Pond C will receive process water (649 gpm) from several plant systems (floor drain, ash hopper seal, station sample, boiler blowdown, sand filter backwash, sanitary waste treatment), as well as a portion (209 gpm) of the cold-side blowdown and runoff (125 gpm) from the coal, limestone, and uncured stabilized waste stockout piles. Bottom ash transport water (4443 gpm) will be recirculated through the Pond C system and the remainder of the outflow (977 gpm) will be consumed in the SO_2 removal system (Figure 2.1-11).

Bottom ash system water will consist of two fractions: supernatant water from the bottom ash/pyrites dewatering bins and water for boiler refractory cooling and sealing of the bottom ash hoppers. Floor drain water, which will contain leakage, spills, and cleanup water, will be treated in an oil separator prior to discharge to Pond C. Coal- and limestone-pile runoff will be collected in a common retention basin (Figure 2.1-14) for settling and filtering prior to entering Pond C. Like others, this basin will store a once-in-10-year, 24 hour rainfall plus a 1-foot freeboard. During more severe storms, untreated coal and limestone runoff will be discharged to Sandy Branch (discharge 006, Figure 2.1-11). Water balance in Pond C will depend on operation of the FGD system. Pond C will be sized to store up to 36 days of low volume and sanitary wastewater if the FGD system is not operating.

Sanitary Waste Treatment. Equipment for the sewage plant will include a conventional gravity sewer system and a package sewage treatment designed to process a maximum of 12,500 gpd (250 persons at 50 gpd) during operation and 18,700 gpd (1000 persons at 18.7 gpd) during construction. A surge tank will ensure uniform hydraulic loading. Design will allow the system to alternate between the two treatment modes as the rate of effluent flow demands. Effluent from both modes will be given tertiary treatment consisting of filtration and recirculation. The discharge to Pond C (during operation) and the site area runoff basin (during construction) will be chlorinated.

Boiler Chemical Cleaning. This process will occur approximately once every three years. The wastes will be disposed of by evaporation in the boiler (based on using an organic acid solution for boiler chemical cleaning) and application to onsite fields (phosphate/wastes). If the chemical cleaning procedures do not allow evaporation of the cleaning wastes in the boiler, the wastes will be hauled offsite by a licensed contractor and disposed of.

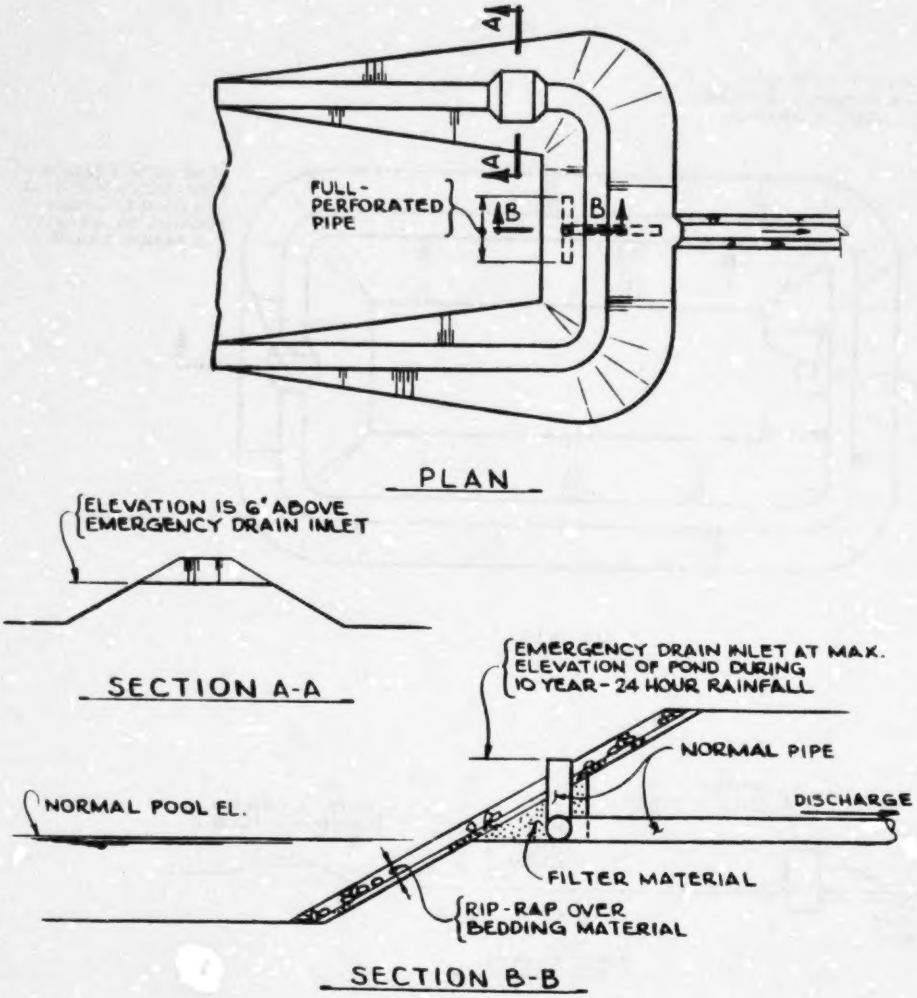
Runoff. Except for coal, limestone, and stabilized waste stockout locations, runoff from the entire site will discharge into streams (Sandy Branch, Muddy Branch, and Indian Creek on the Hancock site; Town Creek on the Breckinridge site). All runoff from cleared locations (including active landfill areas) will be ponded and gravel-filtered prior to discharge (Figure 2.1-15). Additionally, runoff from the switchyard, transformer, and fuel oil



OUTLET TO POND 'C' FOR FLOWS < 10 YEAR-24 HOUR RAINFALL
EMERGENCY SPILLWAY FOR FLOWS > 10 YEAR-24 HOUR RAINFALL. DRAINS BY GRAVITY TO SANDY BRANCH
PLAN
OUTLET STRUCTURE
HIGH SET PT. ELEV.
10 YEAR - 24 HOUR RAINFALL PLUS 1'
OUTLET PIPE TO POND C
SECTION

SOURCE: Sargent & Lundy (1981)

Figure 2.1-14 Coal and Limestone Pile Runoff Pond, Hancock Generating Station


A
A
FULL-
PERFORATED
PIPE
B
B
PLAN
ELEVATION IS 6' ABOVE
EMERGENCY DRAIN INLET
SECTION A-A
EMERGENCY DRAIN INLET AT MAX.
ELEVATION OF POND DURING
10 YEAR - 24 HOUR RAINFALL
NORMAL PIPE
DISCHARGE
NORMAL POOL EL.
FILTER MATERIAL
RIP-RAP OVER
BEDDING MATERIAL
SECTION B-B

SOURCE: Sargent & Lundy (1981)

Figure 2.1-15 Gravel Drain for Retention Ponds, Hancock Generating Station

storage locations will be treated in an oil separator prior to ponding in the site area runoff basin (Figure 2.1-11).

On the Hancock site, a permanent site area retention basin will treat site area runoff prior to discharge into Sandy Branch (discharge 002). Runoff from landfill areas will go through a temporary retention basin to be constructed where landfill is occurring and then be discharged into the drainage area for dilution with runoff from undisturbed and reclaimed locations within the watershed. Dilution factors estimated for active landfill runoff in each of the Hancock site drainage areas are:

Stream	Discharge	Drainage Acres	Dilution Factor of 10-Acre Active Landfill with Waste Less than 30 Days Old
Muddy Branch	003	313	17.7
Sandy Branch	002	1,300	72.0
Indian Creek	004	217	15.7

Runoff from the 25-acre active landfill areas will be segregated from other runoff discharges to Muddy Branch, Sandy Branch, and Indian Creek. This will be accomplished by ditching and diking each active landfill increment to keep water from the remaining landfill area from running through the active area. Water from the active area will be routed to the temporary retention basin and then discharged into the remaining landfill area. Each temporary retention basin will be reclaimed when the landfill increment has been seeded with grass and natural drainage established.

Channelization of Sandy Branch for site area runoff or construction in either Muddy Branch or Indian Creek (none proposed) will occur at points where upstream flow is less than 5 cubic per feet second and will not require a Department of the Army (DA) permit (COE, Louisville District, Personal Communication).

On the Breckinridge site, a permanent site area retention basin will treat site area runoff prior to dischage to Town Creek. Landfill specifications and dilution factors for the Breckinridge site are not available. Any construction on Upper Town Creek (e.g., channelization for site area runoff) will require a DA permit because of flow greater than 5 cubic feet per second (COE Louisville District, Personal Communication).

2.1.4.3.5.3 Discharges

Water quality limitations applicable to wastewater management at the proposed Hancock plant are those of EPA, the Ohio River Valley Water Sanitation Commission (ORSANCO), and the Kentucky DNREP, Division of Water Quality. Expected characteristics of discharges regulated by the United States were submitted to EPA Region IV in the Applicant's NPDES application. EPA's standards for new effluent sources are in Table 2.1-17, which shows those discharges applicable to the Hancock plant keyed to the water flow diagram (Figure 2.1-11) and serial (discharge) number in the permit application; expected effluent concentrations in each discharge are in Table 2.1-18. ORSANCO and Kentucky water quality standards are in Table 2.1-19;

Table 2.1-18 Effluents of the Hancock Generating Station Units 1 and 2

	Daily Average and Maximum Value Expected Per Discharge[1]							
	001		002		003		004	
Parameter	Daily Average	Maximum	Daily Average	Maximum	Daily Average	Maximum	Daily Average	Maximum
Flow (gpm)	1086	1658	605	23033	56	2141	56	2141
pH (standard units)	-	9.0	-	9.0	-	9.0	-	9.0
Temperature (°F)								
Winter	64	69	-	-	-	-	-	-
Summer	82	92	-	-	-	-	-	-
Total Suspended Solids	400	-	50	50	50	50	50	50
Oil and Grease	-	≤15	-	-	-	-	-	-
Aluminum	-	[2]	-	-	-	-	-	-
Ammonia	-	2.65	[2,3]	[2,3]	[2,3]	[2,3]	[2,3]	[2,3]
Arsenic	-	0.068	0.017	0.058	0.017	0.058	0.017	0.058
Cadmium	-	0.136	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorine[4]	0.20	0.50	0.5[3]	0.5[3]	-	-	-	-
Chromium	-	0.680	0.05	0.07	0.05	0.07	0.05	0.07
Copper	-	0.354	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cyanide	-	0.136	-	-	-	-	-	-
Lead	-	0.544	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury	-	0.041	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	-	0.68	-	-	-	-	-	-
Phenols	-	1.22	-	-	-	-	-	-
Selenium	-	0.034	0.009	0.018	0.009	0.018	0.009	0.018
Zinc	-	0.880	0.25	0.65	0.25	0.65	0.25	0.65

[1] All values are milligrams/liter except where noted
[2] No data available
[3] Present only during construction phase
[4] NPDES permit (Appendix 8.1) stipulates instantaneous maximum of 0.1

Source: Hancock Generating Station Units 1 and 2 NPDES Application

Table 2.1-19 Water Quality Standards of Kentucky and the Ohio River Valley Water Sanitation Commission

Pollutant	Kentucky	ORSANCO[4]
pH	6.0-9.0[1]	5.0-9.0
Oil and grease	No visible amount[1] No visible amount[3]	Substantial removal
Fecal coliform (organisms/100 milliliter)	200 (geometric mean)[3]	400 maximum[5], 200 average[5]
Toxic substances (not persistent; noncumulative).	1/10 96-hr LC_{50}[1] 0.44 96-hr LC_{50}[2]	1/20 96-hr MTL
Pesticides and all other toxics	1/100 96-hr LC_{50}	
Color	75 platinum-cobalt color units	–
Dissolved oxygen	4.0 minimum[1], 5.0 average[1]	–
Methylene blue active substances	0.5[3]	–
Phthalate esters	0.003[1]	–
Phenol	0.005[1]	–
Hydrogen sulfide	0.002[1]	–
Sulfate (total)	250[3]	–
Nitrate (NO_3-N, as total)	10	–
Cyanide (free)	0.005 maximum[1]	0.2
Trace Inorganic		
Arsenic	0.05[1]	0.05
Barium	1.0[3]	1.0
Beryllium	0.011-soft water[1] 1.100-hard water[1]	– –
Cadmium	0.004-soft water[1] 0.012-hard water[1]	0.01
Chloride (total)	250[3]	–
Chlorine (total residual)	0.01[1]	–
Chromium (total)	0.100[1] 0.05[3]	0.05
Copper	1.0[3]	–
Fluoride	1[3]	–
Iron	1.0[1]	–
Lead	0.05[3]	0.05
Manganese	0.05[3]	0.05
Mercury	0.00005[1] 0.002[3]	0.005
Selenium	– 0.01[3]	0.01 –
Silver	0.05[3]	0.05
Zinc	5.0[3]	–
Total dissolved solids	750[3]	–

Concentrations in milligrams/liter unless otherwise noted.

[1] Kentucky standards that apply to all waters at the edge of a mixing zone. Applicable to aquatic life. Criteria for determining the size of the mixing zone are that whenever possible, it shall not exceed one-third of the width or cross-sectional area of the receiving stream, and in no case shall exceed one-half of this volume.

[2] Kentucky standards that apply in the mixing zone; applicable to aquatic life.

[3] Kentucky standards that apply at the point water is withdrawn for public water supply.

[4] ORSANCO standards apply at the point of discharge.

[5] These limitations apply from May to October. From November to April, the limitations are 2000/100 milliliters maximum and 1000/100 milliliters average.

Note: Kentucky limitations apply to all regulated water bodies in the state. ORSANCO limitations apply only to the Ohio River.

expected effluent concentrations applicable to these standards are in Table 2.1-20. Discharge locations for the Hancock site are shown in Figure 2.1-16.

Cold-side Blowdown. Makeup flow from the Ohio River will be measured to control the discharge flow rate back to the Ohio River while maintaining 6.8 cycles of operation. The discharge flow rate will vary during normal operation. The flow rate for 1-unit operation typically will be within the range of 0.9 cubic feet per second (cfs) to 2 cfs and will be approximately double for 2-unit operation (1.8 to 4.0 cfs) (Figure 2.1-17).

To insure desired mixing in the river, a single 8-inch diameter discharge port will be used to maintain discharge velocities above 4 feet per second (fps) at flow rates above 800 gpm (Figure 2.1-18). A reducer will be added during operating of Unit 1 prior to startup of Unit 2. The discharge diameter will be reduced to 6 inches to maintain velocities above 6 fps at flow rates above 400 gpm (approximately 0.9 cfs).

Water quality parameters estimated to require dilution to meet Kentucky standards include, for aquatic life, arsenic, and for water supply, fluoride, barium, sulfate, selenium, and chloride. Those parameters that currently have maximum ambient river concentrations exceeding Kentucky standards and therefore cannot meet a standard with a mixing zone include, for aquatic life, iron, mercury, cadmium, phenol, and cyanide, and for water supply, chromium, lead, manganese, and mercury. All parameters will meet the 44% of the acute LC_{50} criterion at the point where the discharge velocity is 2 feet per second. Dilution of parameters above drinking water standards will be assured at the nearest withdrawal point more than 70 miles downriver.

Concentration of pollutants at the edge of the 100-foot mixing zone will be less than 6% above ambient levels and are not expected to cause measurable impact on aquatic organisms in the Ohio River. Toxic pollutants (other than chlorine) will not be added by KU. The Commonwealth presently is evaluating the necessity of a variance to water quality standards for the 6% increase.

Chlorine, added to the cooling water for biofouling, will be limited to a total residual concentration of 0.1 mg/l and will meet water quality standards (0.01 mm/l) by the edge of the mixing zone. Total suspended solids (TSS), which are expected to be 400 mg/l, will be within water supply standards (750 mg/l).

Discharge temperature of the cooling tower blowdown will average 82°F in summer and 64°F in winter, with maximums of 96°F and 69°F in the respective seasons. At maximum plant capacity and greatest differential in discharge and river temperature, a 2°F surface isotherm will occur after a 100 to 1 dilution, as designed in the discharge structure.

Runoff. During plant construction, runoff discharge to Sandy Branch (Hancock site) or Town Creek (Breckinridge site) will have to meet pH and TSS standards. During operation, all discharges to streams will be ground surface effluents only and must meet applicable TSS standards (50 mg/liter). Expected effluent concentrations are in Table 2.1-18.

Table 2.1-20. Expected Effluent Concentrations Relative to ORSANCO and Kentucky Standards (Sheet 1 of 3)

AMBIENT WATER QUALITY, WATER QUALITY STANDARDS AND PLANT DISCHARGE VALUES
(ALL VALUES IN mg/l)

PARAMETERS REQUIRING NO MIXING ZONE

PARAMETER	AMBIENT RIVER WATER QUALITY[1]			AQUATIC LIFE[2]	WATER SUPPLY[3]	ACUTE LC50[4]	PERCENT OF ACUTE LC50			DISCHARGE MAXIMUM[1]
	MAX.	MIN.	AVG.				44%	10%	1%	
pH	8.50	6.50	7.19	6.0-9.0[5]	--	--	--	--	--	6.0-9.0
Calcium	65.90	21.50	41.0	---	--	--	--	--	--	448
Fec. Coli. Bact.	*	*	*	---	2000/100ml[6]	--	--	--	--	--
Potassium	2.60	2.50	2.55	---	--	--	--	--	--	17.7
Sodium	37.0	8.8	18.8	---	--	--	--	--	--	251.6
Phosphate	0.55	0.18	0.37	---	--	*	--	--	--	3.74
Magnesium	8.90	7.30	8.10	---	--	--	--	--	--	60.5
Ammonia	0.39[23]	0.0	0.104	4.0[24]	--	*	--	--	--	2.65

PARAMETERS REQUIRING A MIXING ZONE
( ) - DILUTIONS REQUIRED FOR MIXING ZONE

PARAMETER	AMBIENT RIVER WATER QUALITY[1]			AQUATIC LIFE[2]	WATER SUPPLY[3]	ACUTE LC50[4]	PERCENT OF ACUTE LC50			DISCHARGE MAXIMUM[1]
	MAX.	MIN.	AVG.				44%	10%	1%	
Arsenic	0.010	0.00	0.0045	0.05 (1.4)	--	19.5[7]	6.6	***	***	0.068
Flouride	0.41	0.13	0.24	--	1.0 (3.1)	*	--	--	--	2.79
Barium	0.20	0.00	0.15	--	1.00 (1.5)	*	--	--	--	1.36
Sulfate	164.0	0.097	73.05	--	250 (12.6)	*	--	--	--	1332
Chloride	53.0	0.072	23.06	--	250 (1.6)	*	--	--	--	360
Chlorine	*	*	*	0.01 (9)	--	0.19[8]	0.084 (1.2)	***	***	0.10
Nickel	0.100	0.004	0.069	--	--	18.49[9]	8.14	***	0.185 (5.8)	0.680
Selenium	0.005	0.0	0.0017	--	0.01 (4.8)	3.11[10]	1.37	***	0.0311 (1.1)	0.034

PARAMETERS REQUIRING A MIXING ZONE WITH EXPLANATION[22]
( ) - DILUTIONS REQUIRED FOR MIXING ZONE

PARAMETER	AMBIENT RIVER WATER QUALITY[1]			AQUATIC LIFE[2]	WATER SUPPLY[3]	ACUTE LC50[4]	PERCENT OF ACUTE LC50			DISCHARGE MAXIMUM[1]
	MAX.	MIN.	AVG.				44%	10%	1%	
Chromium	0.10	0.00	0.022	0.1 (8.4)	0.05	22.7[11]	10.0	***	***	0.680
Zinc	0.130	0.0001	0.053	--	5.0	9.6[12]	4.2	***	0.096	0.880
Cadmium	0.020	0.0	0.004	0.012	--	6.5[13]	2.86	***	***	0.136
Copper	0.052	0.0001	0.0236	--	1.0	0.35[14] (1.0)	0.154 (2.0)	0.035	***	0.354
Lead	0.080	0.0	0.019	--	0.05	94.5[15]	41.6	***	0.945	0.544
Manganese	0.560	0.020	0.148	--	0.05	*	--	--	--	3.81
Mercury	0.006	0.0	0.0004	0.00005	0.002	0.168[16]	0.072	***	***	0.041
Silver	0.002[17]	0.0	0.0004	--	0.05	0.046[18]	0.02	***	0.0005	0.0136
Phenol	0.180	0.0	0.005	0.005	--	34.8[19]	15.3	***	***	1.22
Cyanide	0.020[20]	0.0	0.0031	0.005	--	0.125[21] (1.1)	0.055 (2.3)	***	***	0.136
Iron	3.23	1.50	2.58	1.0	--	*	--	--	--	22.0

* - No data available.

** - Only value available.

*** - Not applicable.

___ - Indicates exceeded criterion.

Table 2.1-20. Expected Effluent Concentrations Relative to ORSANCO and Kentucky Standards (Sheet 2 of 3)

1. Ambient river water quality concentrations, except for silver, cyanide and ammonia, were obtained from the EPA's computerized water quality data base, STORET, for the Ohio River around the Cannelton Dam in a STORET run dated July 29, 1979. Ambient river concentrations for silver, cyanide and ammonia were obtained from the EPA due to questionable data in the July 29, 1979 STORET run. The EPA data is also from STORET. Sufficient river data are not available for aluminum, antimony, beryllium boron, cobalt, thallium, titanium, tin, nitrate, nitrite, organic nitrogen, sulfite, bromide, sulfide and molybdenum to determine ambient maximum, minimum and average river concentrations and concentrations in plant discharges. Maximum discharge concentrations are based on maximum ambient river concentrations at 6.8 cycles of concentration.

2. Aquatic life values obtained from Table II of 401 KAR 5:031, Surface Water Standards.

3. Water supply values were obtained from Table III of 401 KAR 5:031, Surface Water Standards.

4. Acute LC_{50} values as originally supplied for the Hancock Unit 1 EIS in July 1980 were obtained from the U.S. EPA Proposed Water Quality Criteria released for public comment on March 15, July 25, and October 1, 1979. In October 1980, the EPA published the final Water Quality Criteria. Inasmuch as the 1980 document reflects the latest information regarding LC_{50} values as they relate to water quality criteria, the LC_{50} values listed in this table were obtained from information appearing in it.

5. 401 KAR 5:031, Surface Water Standards, p. 3.

6. Geometric mean.

7. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Arsenic. Fathead minnor (juvenile). p. B-13. NOTE: Only fathead minnow value listed.

8. U.S. Environmental Protection Agency, 1976. Quality Criteria for Water. Golden shiner. p. 34.

9. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Nickel. Calculation of acute LC_{50} for fathead minnow with slope=0.83, intercept=5.76, hardness=134 mg/l as $CaCO_3$. p. B-17.

10. Acute LC_{50} value for selenium is the geometric mean of LC_{50} values for fathead minnow exposed to selenium dioxide. These values are presented on page B-13 and B-14 of U.S. Environmental Protection Agency, 1980, Ambient Water Quality Criteria. Selenium.

11. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Chromium. Calculation of Acute LC_{50} for fathead minnow with slope=0.83, intercept=5.98, hardness=134 mg/l as $CaCO_3$. p. B-26.

12. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Zinc. Calculation of acute LC_{50} for fathead minnow with slope=0.78, intercept=5.39, hardness=134 mg/l as $CaCO_3$. p. B-27.

13. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Cadmium. Calculation of acute LC_{50} for fathead minnow with slope=1.25, intercept=2.66, hardness=134 mg/l as $CaCO_3$. p. B-27.

14. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Copper. Calculation of acute LC_{50} for fathead minnow with slope=1.12, intercept=0.38, hardness=134 mg/l as $CaCO_3$. p. B-31.

Table 2.1-20. Expected Effluent Concentrations Relative to ORSANCO and Kentucky Standards (Sheet 3 of 3)

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15. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Lead. Calculation of acute LC_{50} for fathead minnow with slope=1.60, intercept=3.62, hardness=134 mg/l as $CaCO_3$. p. B-15.

16. Acute LC_{50} value for mercury is the arithmetic mean of the only two acute LC_{50} values for fathead minnow listed in U.S. Environmental Protection Agency, 1980, Ambient Water Quality Criteria. Mercury. p. B-17.

17. This value obtained from U.S. Environmental Protection Agency.

18. U.S. Environmental Protection Agency, 1980. Ambient Water Quality Criteria. Silver. Calculation of acute LC_{50} for fathead minnow with slope=1.50, intercept=-3.52, hardness=134 mg/l as $CaCO_3$.

19. Acute LC_{50} value for phenol is the geometric mean of LC_{50} values for fathead minnow listed in U.S. Environmental Protection Agency, 1980, Ambient Water Quality Criteria. Phenol. pp. B-7 and B-8.

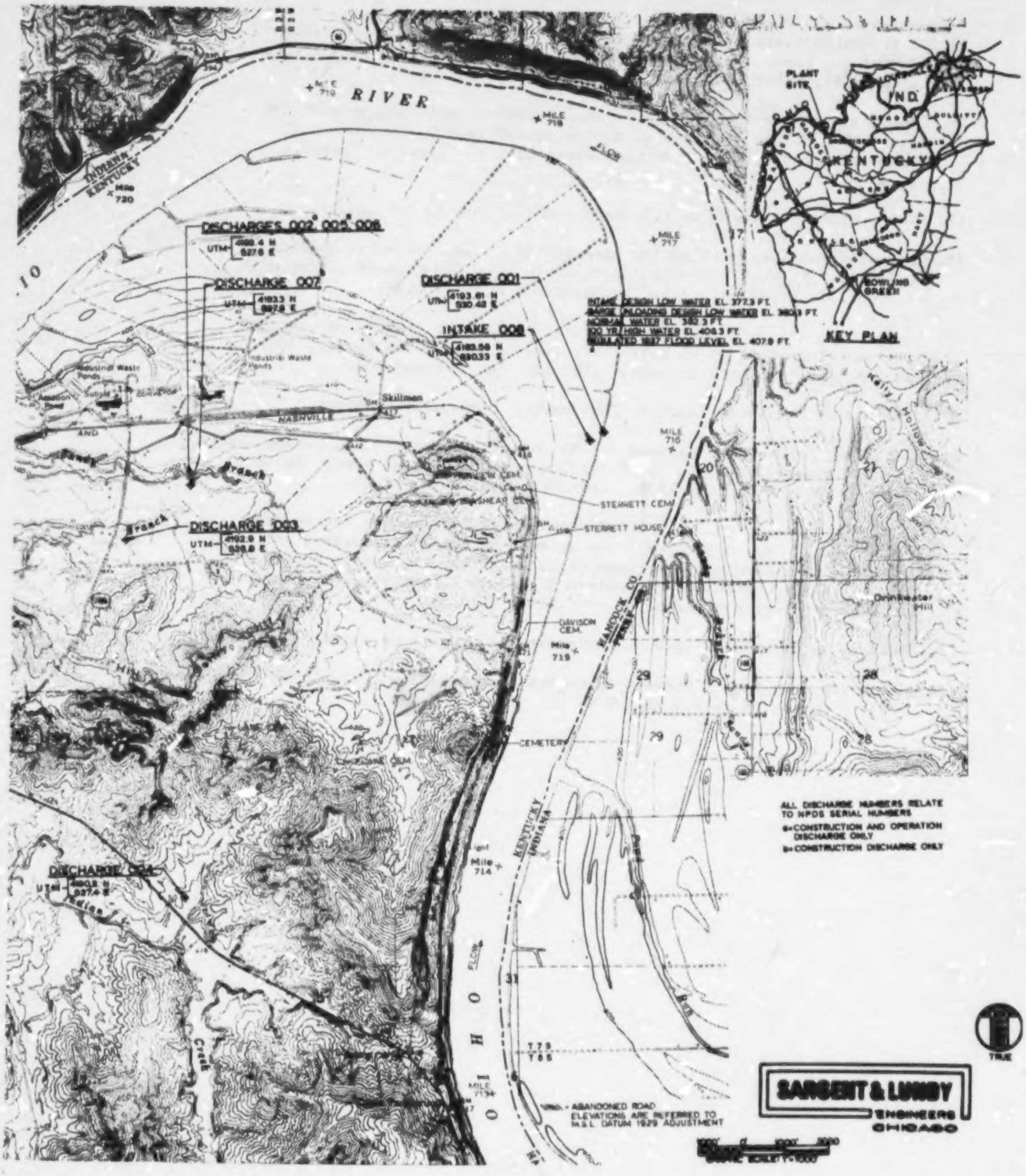
20. This value obtained from U.S. Environmental Protection Agency.

21. Acute LC_{50} value for cyanides is the geometric mean of LC_{50} values for fathead minnow listed in U.S. Environmental Protection Agency Ambient Water Quality Criteria, 1980. Cyanides. pp. B-10 - B-12.

22. Parameters listed on Table 2.1-20 Parameters Requiring a Mixing Zone with Explanation, cannot meet one or more of the water quality criteria with a mixing zone since maximum river water concentrations exceed the water quality criteria. Parameters listed in this table are within 6% of ambient river concentration with 100:1 dilution.

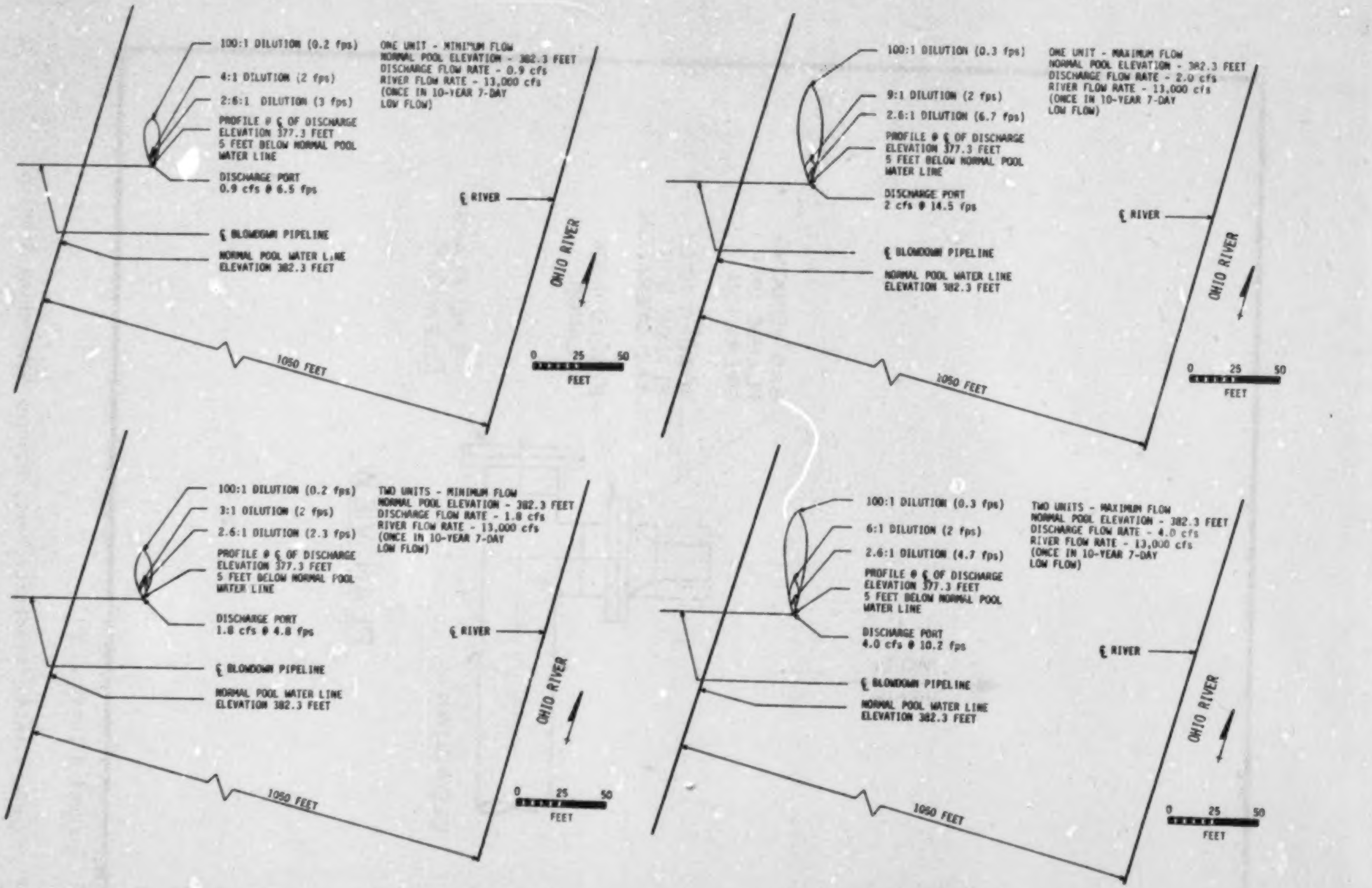
23. This value obtained from U.S. Environmental Protection Agency.

24. Value obtained from "Instream Ammonia-N Concentration". Table in 401 KAR 5:031 assuming pH of 7.5 and 20°C.


RIVER
MILE 719
MILE 718
MILE 717
MILE 716
MILE 715
MILE 714
MILE 720
INDIANA
KENTUCKY
FLOW
DISCHARGES 002 005 006
DISCHARGE 007
DISCHARGE 001
UTM 4163.61 N 630.48 E
INTAKE 008
UTM 4163.06 N 630.33 E
INTAKE DESIGN LOW WATER EL. 377.3 FT.
BARGE UNLOADING DESIGN LOW WATER EL. 380.0 FT.
NORMAL WATER EL. 382.3 FT.
100 YR. HIGH WATER EL. 406.3 FT.
SIMULATED 1937 FLOOD LEVEL EL. 407.8 FT.
Industrial Waste Ponds
Skillman
NASHVILLE
Branch
DISCHARGE 003
DISCHARGE 004
UTM
STERRETT CEM.
STERRETT HOUSE
DAVISON CEM.
CEMETERY
HANCOCK
Drinkwater Hill
Kelly Hollow
O H I O
ABANDONED ROAD
ELEVATIONS ARE REFERRED TO M.S.L. DATUM 1929 ADJUSTMENT
PLANT SITE
IND.
KENTUCKY
BOWLING GREEN
KEY PLAN
ALL DISCHARGE NUMBERS RELATE TO NPDS SERIAL NUMBERS
a=CONSTRUCTION AND OPERATION DISCHARGE ONLY
b=CONSTRUCTION DISCHARGE ONLY
TRUE
SARGENT & LUNDY ENGINEERS CHICAGO

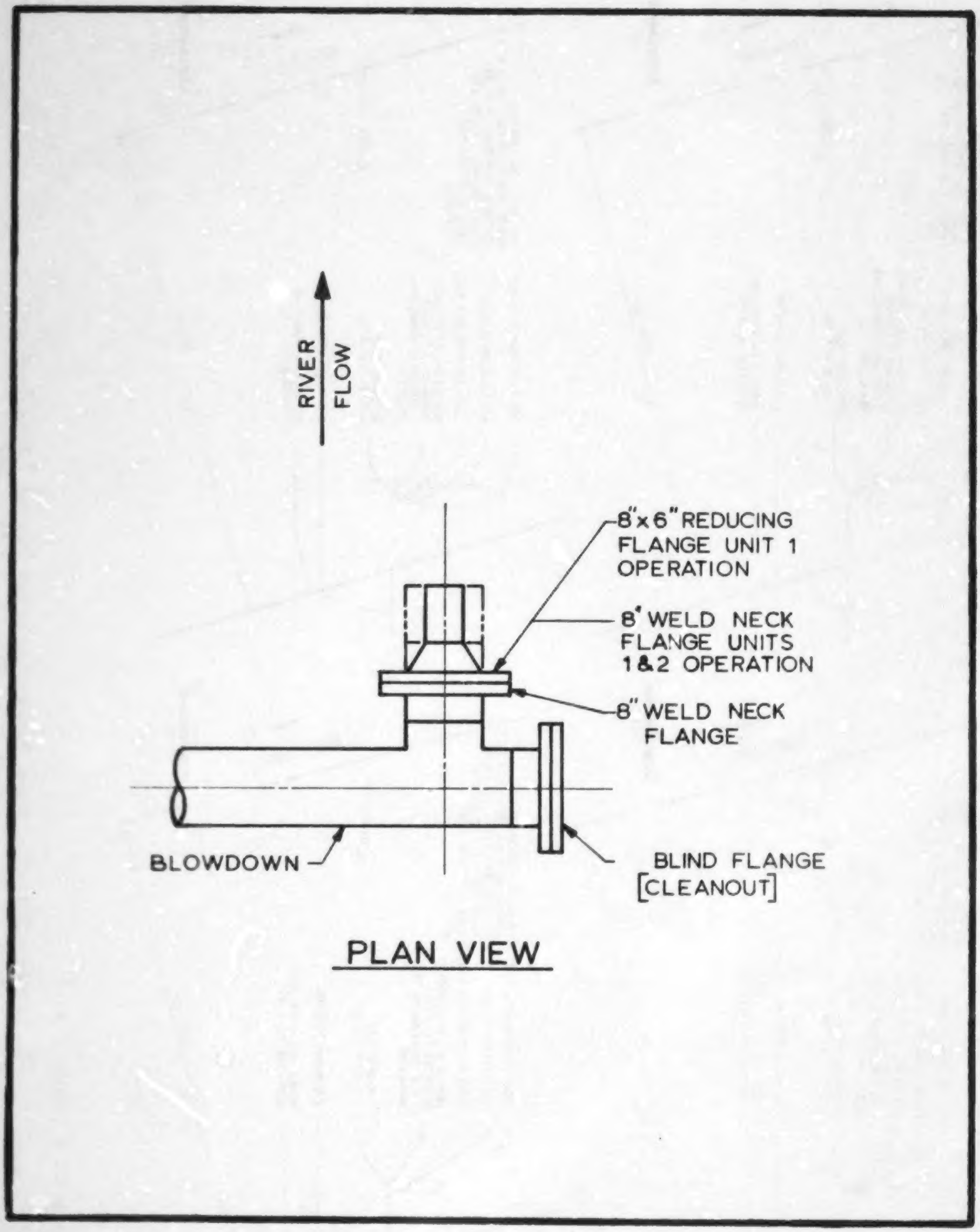
SOURCE: Sargent & Lundy (1981)

Figure 2.1-16. Discharge Locations, Hancock Generating Station


100:1 DILUTION (0.2 fps)
4:1 DILUTION (2 fps)
2:6:1 DILUTION (3 fps)
PROFILE @ ℄ OF DISCHARGE ELEVATION 377.3 FEET 5 FEET BELOW NORMAL POOL WATER LINE
DISCHARGE PORT 0.9 cfs @ 6.5 fps
℄ BLOWDOWN PIPELINE
NORMAL POOL WATER LINE ELEVATION 382.3 FEET
ONE UNIT - MINIMUM FLOW
NORMAL POOL ELEVATION - 382.3 FEET
DISCHARGE FLOW RATE - 0.9 cfs
RIVER FLOW RATE - 13,000 cfs
(ONCE IN 10-YEAR 7-DAY LOW FLOW)
℄ RIVER
OHIO RIVER
1050 FEET
0 25 50
FEET
100:1 DILUTION (0.3 fps)
9:1 DILUTION (2 fps)
2.6:1 DILUTION (6.7 fps)
PROFILE @ ℄ OF DISCHARGE ELEVATION 377.3 FEET 5 FEET BELOW NORMAL POOL WATER LINE
DISCHARGE PORT 2 cfs @ 14.5 fps
℄ BLOWDOWN PIPELINE
NORMAL POOL WATER LINE ELEVATION 382.3 FEET
ONE UNIT - MAXIMUM FLOW
NORMAL POOL ELEVATION - 382.3 FEET
DISCHARGE FLOW RATE - 2.0 cfs
RIVER FLOW RATE - 13,000 cfs
(ONCE IN 10-YEAR 7-DAY LOW FLOW)
℄ RIVER
OHIO RIVER
1050 FEET
0 25 50
FEET
100:1 DILUTION (0.2 fps)
3:1 DILUTION (2 fps)
2.6:1 DILUTION (2.3 fps)
PROFILE @ ℄ OF DISCHARGE ELEVATION 377.3 FEET 5 FEET BELOW NORMAL POOL WATER LINE
DISCHARGE PORT 1.8 cfs @ 4.8 fps
℄ BLOWDOWN PIPELINE
NORMAL POOL WATER LINE ELEVATION 382.3 FEET
TWO UNITS - MINIMUM FLOW
NORMAL POOL ELEVATION - 382.3 FEET
DISCHARGE FLOW RATE - 1.8 cfs
RIVER FLOW RATE - 13,000 cfs
(ONCE IN 10-YEAR 7-DAY LOW FLOW)
℄ RIVER
OHIO RIVER
1050 FEET
0 25 50
FEET
100:1 DILUTION (0.3 fps)
6:1 DILUTION (2 fps)
2.6:1 DILUTION (4.7 fps)
PROFILE @ ℄ OF DISCHARGE ELEVATION 377.3 FEET 5 FEET BELOW NORMAL POOL WATER LINE
DISCHARGE PORT 4.0 cfs @ 10.2 fps
℄ BLOWDOWN PIPELINE
NORMAL POOL WATER LINE ELEVATION 382.3 FEET
TWO UNITS - MAXIMUM FLOW
NORMAL POOL ELEVATION - 382.3 FEET
DISCHARGE FLOW RATE - 4.0 cfs
RIVER FLOW RATE - 13,000 cfs
(ONCE IN 10-YEAR 7-DAY LOW FLOW)
℄ RIVER
OHIO RIVER
1050 FEET
0 25 50
FEET

SOURCE: Sargent & Lundy (1981)

Figure 2.1-17. Ohio River Discharge Mixing Zone, Hancock Generating Station Units 1 and 2


RIVER FLOW
8"x6" REDUCING FLANGE UNIT 1 OPERATION
8" WELD NECK FLANGE UNITS 1&2 OPERATION
8" WELD NECK FLANGE
BLOWDOWN
BLIND FLANGE [CLEANOUT]
PLAN VIEW

SOURCE: Sargent & Lundy (1981)

Figure 2.1-18. Discharge Port, Hancock Generating Station

Water Quality Assurance. KU proposes to monitor surface water quality and groundwater quality each month, with quarterly reports to the Kentucky DNREP and EPA Region IV. This program is a condition of the NPDES permit, Part III (see Appendix 8.1).

2.1.4.4 Coal and Limestone Handling System

Plans for coal and limestone management at the Hancock plant include a dual-purpose unloading and conveyor system. Both substances will be delivered by 1500-ton barge to dock facilities located on the Ohio River (RM 715, Hancock site; RM 703.5, Breckinridge site).

Dock Facilities. Design of dock facilities proposed for the Hancock site is shown in Figure 2.1-19. The unloader will require open barges, which will be positioned at the dock by tow boat. The dock facilities will accommodate 15 full coal barges, 9 full limestone barges, and the same number of empty barges.

In reviewing the Applicant's application for a DA permit, the Louisville District COE has determined that the barge and fleeting facility arrangement now proposed for the Hancock site (Figure 2.1-19) is a significant projection into the Ohio River and will present a moderate hazard to navigation. Construction of the barge docking facilities will vary from somewhat more than 600 feet (downstream end) to 370 feet (upstream end) inland from the existing river channel. With docked barges, the outer barge will reduce the facility-to-sailing line distance to 265 feet at the upstream end.

Additional potential hazard to navigation is the chance of barge breakaway at the docking facilities The Applicant will reduce the potential for breakaway by having a tow boat at the site whenever barges are docked there.

During the DA permit application review, the Applicant provided the COE with 14 potential fossil-fuel power plant sites for evaluation of navigation impact. These potential sites included the nine preferred sites and five others identified in the site selection study described in Section 2.1.3. The COE rated each site on a scale of 1 to 5, where 1 = no impact, 3 = moderate impact, and 5 = extreme impact. The Hancock site (Ohio RM 715) received a 5 rating and the Breckinridge site (RM 704) received a 4 rating. The best rating received by a site having potential navigation impact was 2. Among the preferred sites, L-8 and L-17, which would require fuel delivery by rail, were given a 1 rating. Among the other preferred sites, O-22 received a 5 rating, G-1, O-8, O-11, were given 3 ratings, and O-12 received a 2 rating.

Unloader and Conveyor System. The bucket-ladder type unloader will be designed to operate at full speed to empty a coal barge in about 50 minutes and at one-half speed to unload the denser limestone at the same rate. The unloader will feed into a covered conveyor system with a 520-foot-per-minute belt speed, which is within maximum recommended speed (600 fpm) for conveying crushed stone (Conveyor Equipment Manufacturers Association). The conveyor system will be self-cleaning; chute-work at transfer points will be designed to keep material dribble from accumulating; belt cleaning devices will be installed at critical points; and empty conveyors will continue operation for

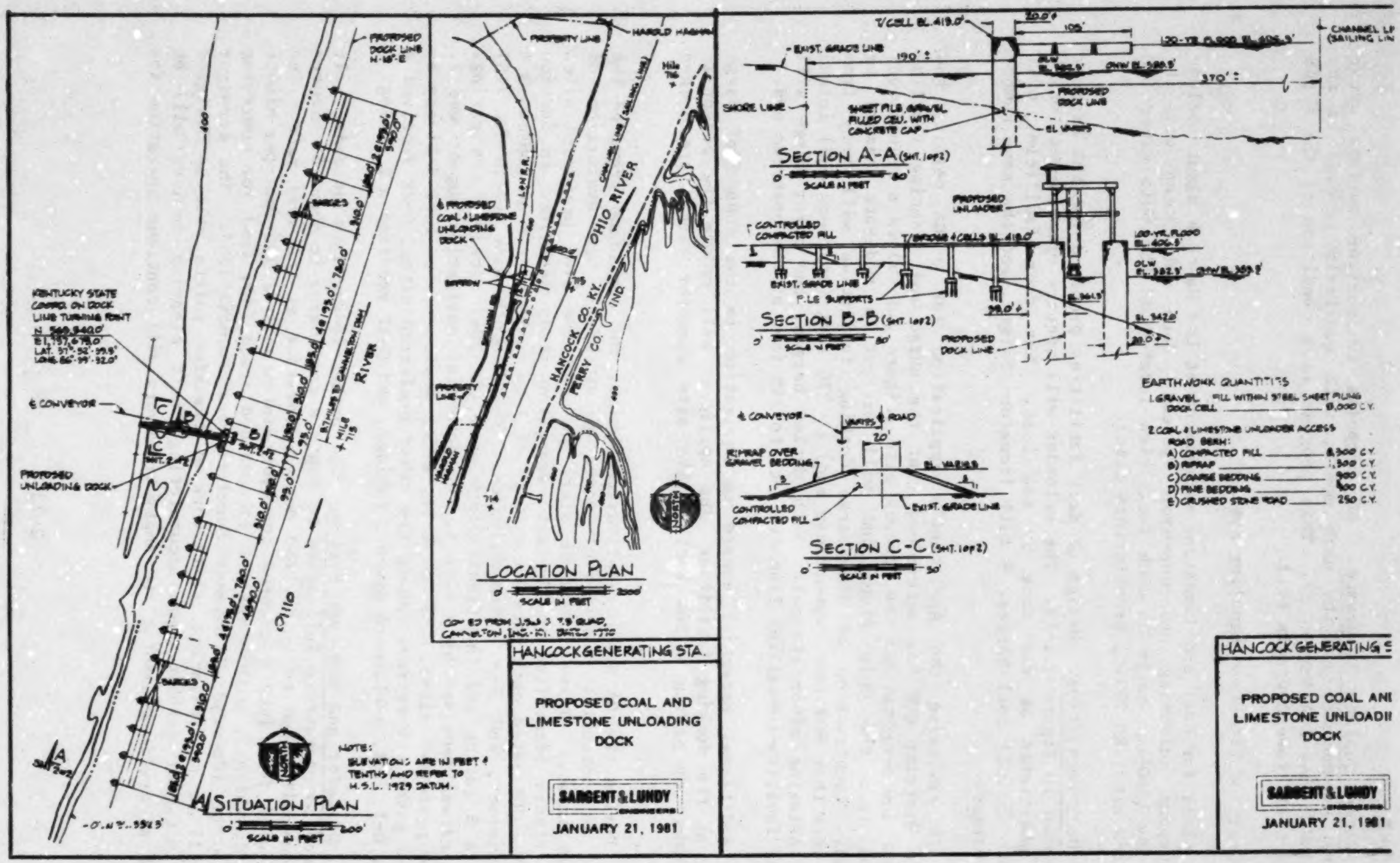

PROPOSED DOCK LINE N 18° E
KENTUCKY STATE COORD. ON DOCK LINE TURNING POINT
N. 560,940.0'
E1,737,679.0'
LAT. 37°-52'-39.5'
LONG. 86°-39'-32.0'
℄ CONVEYOR
PROPOSED UNLOADING DOCK
BARGES
RIVER
OHIO
MILE 715
SITUATION PLAN
SCALE IN FEET
NOTE:
ELEVATIONS ARE IN FEET & TENTHS AND REFER TO M.S.L. 1929 DATUM.
PROPERTY LINE
HAROLD HAGMAN
℄ PROPOSED COAL & LIMESTONE UNLOADING DOCK
L&N R.R.
OHIO RIVER
HANCOCK CO. KY.
PERRY CO. IND.
LOCATION PLAN
SCALE IN FEET
HANCOCK GENERATING STA.
PROPOSED COAL AND LIMESTONE UNLOADING DOCK
SARGENT & LUNDY ENGINEERS
JANUARY 21, 1981
T/CELL EL. 419.0'
EXIST. GRADE LINE
190' ±
105'
100-YR. FLOOD EL. 406.5'
OLW EL. 382.5'
ONW EL. 383.5'
370' ±
CHANNEL LINE (SAILING LINE)
SHORE LINE
SHEET PILE, GRAVEL FILLED CELL WITH CONCRETE CAP
PROPOSED DOCK LINE
EL. VARIES
SECTION A-A (SHT. 1 OF 2)
SCALE IN FEET
PROPOSED UNLOADER
CONTROLLED COMPACTED FILL
T/BRIDGE & CELLS EL. 419.0'
EXIST. GRADE LINE
PILE SUPPORTS
SECTION B-B (SHT. 1 OF 2)
℄ CONVEYOR
VARIES ℄ ROAD
20'
RIPRAP OVER GRAVEL BEDDING
EL. VARIES
CONTROLLED COMPACTED FILL
EXIST. GRADE LINE
SECTION C-C (SHT. 1 OF 2)
EARTHWORK QUANTITIES
1. GRAVEL FILL WITHIN STEEL SHEET PILING DOCK CELL — 8,000 C.Y.
2. COAL & LIMESTONE UNLOADER ACCESS ROAD BERM:
A) COMPACTED FILL — 8,300 C.Y.
B) RIPRAP — 1,300 C.Y.
C) COARSE BEDDING — 900 C.Y.
D) FINE BEDDING — 900 C.Y.
E) CRUSHED STONE ROAD — 250 C.Y.
HANCOCK GENERATING S
PROPOSED COAL AN
LIMESTONE UNLOADI
DOCK
SARGENT & LUNDY ENGINEERS
JANUARY 21, 1981

Figure 2.1-19. Proposed Coal and Limestone Unloading Dock, Hancock Generating Station

a predetermined time prior to material changeover to allow maximum belt cleaning.

From the dual-purpose coal and limestone conveyance structures, limestone will be diverted to a separate limestone conveyor system via a gate that will open only when the unloader system is in the limestone operating mode. The limestone will go to an active stockout pile. A yard vehicle will transfer the material to either an inactive storage pile or to a dual reclaim conveyor system for transfer to daybins in the limestone preparation building. Coal will be reclaimed from inactive storage by yard vehicles and from active storage by gravity. It will be conveyed to a crusher house and then to pulverizers for pneumatic feed to the boilers.

Fugitive Emissions. Collection systems with parallel fabric bag filters will be at all transfer points in the conveyor systems. Exposed storage piles will be compacted and watered as necessary; haul roads also will be sprayed with water as necessary. Based on 50% emissions control for wet suppression and 50 to 99% control efficiency for the other mechanisms, total fugitive emissions are predicted to be 35.9 tons per year. Maximum 24-hour fugitive emissions are estimated at 425 pounds per day (see Table 2.1-12).

Fugitive dust contamination from KU's inactive coal pile is a major concern of a bleached pulp mill (Willamette Industries) that is located adjacent to the Hancock site. There are two means of coal dust contamination in the pulp process: deposition of airborne coal particles on Willamette's wood chip storage piles (located approximately 7400 feet from KU's coal pile) and incorporation of airborne coal particles into the bleached pulp during the drying process (occurs in a building about 6000 feet from KU's coal pile). Unlike other forms of fugitive dust, coal particles apparently cannot be washed completely from the chips and pulp during various stages of the pulp process. Potential impacts to the bleached pulp attributable to KU are discussed in Section 3.2.2.

2.1.4.5 Site Development Procedures

KU will comply with erosion control procedures and those to mitigate impacts to archaeological resources, as stipulated in the draft NPDES permit, Part III (see Appendix 8.1 and Subsection 3.1.3.2). Additionally, KU will require contractors to follow appropiate, low-impact procedures for waste materials disposal, dust and emissions control, traffic control, and noise control. These procedures will include sale of merchantable trees; burning of slash and unsold timber; recycling of appropriate materials; compliance with collection and disposal regulations for fuels, lubricants, and other chemicals; water spraying of exposed ground; use of excavated material for fill; and proper designation of entrance and exit roads and parking areas. A county sanitary landfill, recently required by Kentucky law, will be used for scraps. Site clearing will occur in stages and developed areas will be revegetated to the extent possible.

2.1.4.6 Transmission System

The transmission facilities and system tie-in requirements described for the Hancock (Subsection 2.1.3.2) and Breckinridge (Subsection 2.1.3.3) sites represent the most efficient way to distribute power from the station to KU's service area. New transmission construction will be minimized, thus minimizing costs and environmental impacts. Prior to right-of-way selection, alternative routes will be surveyed for cultural resource potential. Land use and other characteristics of the land surrounding alternative routes from each site have been identified (see Section 3.0)

Right-of-way development, like site development, will follow appropriate and required procedures to minimize impact. The proposed use of stacked steel transmission towers for the entire system, necessitated by unavailability of suitable alternative design, will create a significant visual contrast with existing wooden towers in the Elizabethtown corridor. Similar impact will not occur along the new corridor segments.

Right-of-way maintenance procedures will employ selective vegetation removal in sensitive areas and aerially applied herbicides in other areas. KU's herbicide plan is a condition of the NPDES permit, Part III (see Appendix 8.1).

The transmission facilities for Unit 1 will be constructed during 1988 over a period of 5 to 6 months. Those for Unit 2 will be constructed during 1993 over the entire year. Estimated manpower and costs breakdowns for each unit and each site are:

			Overhead and Material Costs ($Million)	
	Labor (man-months)	Labor Salaries ($Million)	Hancock Site	Breckinridge Site
Unit 1				
Substation	60	0.202	3.053	3.053
Transmission Line	303	1.018	5.116	6.966
Unit 2				
Substation	60	0.393	14.750	14.846
Transmission Line	720	3.145	30.128	25.368
Total	1143	4.758	53.047	50.233

Costs are based on adjusted dollars.
Source: Kentucky Utilities Company (1980).

2.2 NO ACTION

As discussed in Section 1.2, Kentucky Utilities is projected to require, as a minimum after Ghent Units 3 and 4, an additional 213 MW by 1989 and, as a minimum, an additional 892 MW by 1994. Without this new capacity, the Applicant would not be able to serve the projected load levels. Any additional load growth after 1994 will accentuate the need for this capacity.

At this time, KU knows of no source of additional capacity of sufficient magnitude from neighboring utilities at a comparable cost. The Applicant's purchase contract with OMU and EEI is for surplus capacity after OMU and EEI take what they need. As their load grows, EEI's and OMU's needs increase and KU gets progressively less surplus capacity. KU's need for additional capacity to serve even the same KU load will increase each year as the other utilities' loads grow.

The Applicant will have increasingly less ability to serve its loads if load growth continues and additional capacity is not added. The nature of a power system is that no more load can be supplied than the existing, connected generation can supply. Blackouts are the result of a greater load than generation capability.

Rotating blackouts and load control are two common concepts of reducing the customer's load. The Applicant's distribution system is not designed, because it is not practical to do so, to allow a distribution substation or feeder to be de-energized while at the same time leaving an essential service energized (e.g., a hospital served from that feeder or substation). Time, radio, and other forms of remote load control can be used, as for example, in KU's off-peak water heating system. However, these controls are dependent upon public acceptance, are subject to malfunction, and would have to control successively more load as the population and number of customers increase. Peak load pricing could be used to reduce the average daily peak load, but it is doubtful if it would reduce the system peak loads experienced during periods of extreme temperatures. Further, the social and political acceptance of such a strategy is questioned. The social conscience allowing peak load pricing when the temperature is sub-zero or in the high 90's is questionable since these are exactly the weather conditions that produce the system peak loads experienced.

In general, the effects of insufficient electric generating capacity could ultimately influence the economy of the service area. Any quantitative analysis of effects would be difficult to perform since each consumer (residential/commercial/industrial) would be affected differently. In time though, without additions to the generating system and with an increasing consumer base, no reserve capacity would be available. Further increases in the consumer base would require, on a continuing basis, all consumers to reduce their electrical consumption so that new consumers could share in the limited supply of electrical power. Since new industry or major commercial developments could not be assured of a viable source of electrical power, the tendency would be to not locate in the affected regions.

Reductions in existing industrial or commercial production resulting from inadequate electrical power supplies would lead to reductions in existing employment. Because new industrial or commercial development would be unlikely, unemployment would not decrease and affected workers would be less likely to expend their limited resources on goods and services.

It is recognized these effects would not be evident for several years. However, blackouts during peak load conditions could occur on a more frequent basis when the reserve capacity is reduced below an accepted level (approximately 20% of the total system capacity). This level of reserve capacity is projected to be reached in 1987/1988 (see Section 1.2.1).

The immediate effects of the no-action alternative (nonissuance of an NPDES permit) would not significantly influence the environmental setting of the project area. In fact, the existing environment would be expected, at least for the near future, to retain its rural setting. Impacts (adverse and beneficial) associated with the project (as discussed in Section 3.0) would not be realized. Air increments and water resources would not be consumed, vegetation would not be disrupted, barging traffic would not increase (due to this project), vehicle traffic would not increase (due to this project), and Hancock County would not realize tax monies that would be generated.

In the long term (within the life of the proposed project), some industrial development of the site is likely because of its location on a major navigable river, access to a rail system, and availability of water resources. The proposed site represents highly desirable industrial real estate and has been designated as a potential industrial site by the Kentucky Department of Commerce and the Green River Area Development District. The no-action alternative might allow the officials of Hancock County to attract industrial development to the proposed site that is more favorable in the county's perspective. Thus, it is unknown how in the long term the existing environment would be affected.

2.3 OTHER ALTERNATIVES AVAILABLE TO FEDERAL AGENCIES AND THE COMMONWEALTH OF KENTUCKY

The no-action alternative pertains to nonissuance of the NPDES permit. Other permits can be denied. Decisionmakers also can defer action or issue permits with conditions.

2.3.1 Deny Permits

The effects of this alternative were basically described in the no action scenario above. Major permits required for the project include those previously mentioned (NPDES, PSD, DA) and a Certificate of Environmental Compatibility, Certificate of Convenience and Necessity, Construction Permit, Operations Permit, Water Quality Certificate, and Floodway Construction Permit, all from Commonwealth agencies. Denial of any one of the permits would preclude some of the impacts described herein. However, if the Applicant's premise of need for the proposed generating station is accepted, denying the project would cause the other impacts described above.

2.3.2 Defer Decision

Decisionmakers have the option of not approving permits until other information is known. There will be economic costs of deferral, primarily in capital expenditures. The initial (1978) projection for the cost of constructing Hancock Units 1 and 2 was $1.3 billion. The present (1981) projection is $1.8 billion, based on an estimate of 10% annual inflation. Kentucky Utilities may recoup these costs should the Public Service Commission allow them to be passed along to customers.

Environmental impacts will not occur during the time that the decisions are deferred. After the deferral period, these impacts will be similar or identical to those described herein, depending on length of deferral and changes in existing conditions.

The energy-related effects of a decision to defer Federal or Commonwealth action were mentioned relative to denying permits. Obviously, deferral of decisions will cause a delay in the availability of energy from Hancock Units 1 and 2. If the Applicant's forecasts are correct, a source of energy (e.g., short-term conservation, short-term curtailment) would be required to meet loads now projected for 1989 through 1994, when Unit 1 would have been operating. If the decision at the end of the deferral period is to deny the permits, a vigorous program will have to be initiated to find replacement resources over the short and long term.

2.3.3 Issue Permits With Conditions

If proposed Ohio River intake and discharge structures were unsuitable because of adverse effects on erosion or navigation, the Corps of Engineers could require change in those structures before issuing permits for construction. Similarly, the COE could issue a permit that would require modifications of the existing proposal for barge facilities.

EPA could require construction or operational modifications to protect the environment from effects of airborne emmissions or water quality alterations, prior to issuance of the permits or as conditions to them.

The Kentucky Public Service Commission could influence the time phased capacity increase by allowing price structures that promoted conservation or implemented curtailment policies.

There are a number of other permit stipulations that could affect the project. Where construction or operational modifications are required, the length of time necessary to design them and evaluate them may produce effects similar to those described above.

2.4 EPA's PREFERRED ALTERNATIVE AND RECOMMENDED ACTION

Based upon a positive need for power determination from the Kentucky Public Service Commission (KPSC) and EPA's evaluation of the impacts of the proposed project and alternatives, EPA would find the project alternative proposed by KU to be environmentally acceptable. The alternative preferred by EPA would therefore be as follows:

Management: Additional generating units

Fuel: Coal

Site: Skillman Bottoms or Holt Bottoms

Waste heat rejection: Mechanical draft cooling towers with offshore slotted screens (cooling water to be drawn from the Ohio River)

Air emmissions control:

Particulates--electrostatic precipitators

Sulfur Dioxide--limestone scrubber

Nitrogen oxide--boiler design

Residual solid waste disposal: Stabilized waste disposed onsite

Transmission facilities: Tie-in lines to corridors south of the site

If, based on projected demands, the KPSC should determine the proposed Hancock County facility is not needed, EPA's preferred alternative would be nonissuance of an NPDES permit.

The assessment of environmental impacts associated with alternative siting options indicates that, overall, location of the power plant in Breckinridge County (Holt Bottoms) could be environmentally and socioeconomically preferable to siting the power plant in Hancock County (Skillman Bottoms). However, both sites are environmentally acceptable.

The major significant issues that must be factored into the siting determination are the cumulative impact of a 1300 MW (net) power plant and a 25,000 tons of coal per day synfuel plant in the Holt Bottoms area and the nonenvironmental but potential incompatibility of the power plant and Willamette Industries' paper mills in the Skillman Bottoms area.

The Commonwealth of Kentucky, through the Kentucky Department of Energy, has placed earnest money on the Holt Bottoms property proposed for the synfuel plant. This particular tract was originally considered by KU as the Breckinridge site alternative. The present Breckinridge site alternative is north of the original site and on less favorable property. Additionally, the cumulative operational impacts of these two projects would likely cause a severe stress on the air resources of the area. Until more detailed information on the proposed synfuel plant is available, a more specific assessment of this cumulative impact is not possible. Should siting of both facilities in the Holt Bottoms area appear to jeoparidze the existence of the synfuel plant, it is unlikely the Commonwealth would allow KU to locate at this area (because of the Commonwealth's involvement with the synfuel project). Cumulative concurrent construction impacts of these facilities would also be more significant if both were sited in Holt Bottoms.

Should coal dust in sufficient quantity impinge on Willamette Industries' wood chip pile, Willamette could experience an economic loss. Loss of one day's bleached pulp product could approach $187,000. At this time, due to the lack of specific similar conditions and industry analyses, the exact frequency and significance of this impact is unknown. The best professional judgment is that there could be an influence on pulp quality but this potential impact cannot be demonstrated by state-of-the-art air modeling and is expected to be infrequent. Analysis also indicates that this potential impact could be further mitigated. Without in situ demonstrations more specific conclusions connot be reached. Measures that could alleviate this potential impact and appear possible under certain circumstances include covering, partial covering, screening, or moving the coal pile and/or wood chip pile . Receipt of coal at the Hancock site would commence about 1988 for a 1989 startup date. This would allow approximately 7 years for Willamette and KU to develop and implement a program acceptable to both parties, which would protect each party's interests.

The assessment of environmental impacts associated with KU's proposed project included development of mitigative measures to reduce potential adverse environmental impacts of the project. Specifically, EPA recommends that:

(1) A groundwater monitoring program be implemented prior to operation so that should any significant contamination of groundwater occur, corrective measures may be instituted to insure no further significant leaching.

(2) An erosion and sedimentation control program be implemented to prevent silt and soil-ladden runoff during the construction of Units 1 & 2.

(3) The wastewater treatment ponds be lined with two (2) feet of compacted clay to reduce potential leachate contamination to the groundwater regime.

(4) No herbicides be used prior to or during initial mechanical clearing of proposed transmission corridors and that use in corridor maintenance be limited to EPA approved products only.

(5) Runoff from the solid waste disposal areas be monitored to ensure no significant impacts to surface water quality.

(6) All consultation processes relative to significant onsite and transmission corridor cultural and archaeological sites be completed prior to plant construction and that any required excavation or mitigation be performed as recommended by the parties (EPA, KU, Kentucky Heritage Commission, Department of the Interior, Advisory Council) to such consultation.

Pending a determination of need for power from the KPSC, EPA would propose to issue an NPDES permit to KU for Hancock County Generating Station Units 1 and 2. A draft of the proposed NPDES permit is appended to the Draft EIS (Appendix 8.1). The project authorized by the NPDES permit is that described in the Draft EIS and KU's proposed project and shall incorporate all measures identified as conditions of the permit (Part III conditions).

2.5 MITIGATIVE MEASURES NOT INCLUDED IN THE PROPOSED ACTION

In addition to measures listed in Section 2.4 that are conditions for protecting the environment, other measures may be necessary to mitigate the potential for impact of Hancock Generating Station coal dust on Willamette Industries' bleached pulp and fine paper plant. Kentucky Utilities' currently proposed mitigation for fugitive dust includes various equipment and procedures for the coal and limestone handling system that have from 50% to 99% control efficiency. Proposed procedures for controlling fugitive dust emitted from the inactive limestone and coal piles are compaction and wet (water) suppression, which are estimated to provide 50% control. It is believed that greater control efficiency for the inactive coal pile could further reduce the potential for impact on Willamette's products.

Three studies were done in an attempt to determine and describe potential impacts of coal dust on Willamette's bleached pulp product. It should be noted that Willamette currently is expanding operations to include internal processing of the bleached pulp product, which, in the past, has all been sold to other processors. Fine white paper production was not considered in the impact analyses. The primary factor considered was contamination of Willamette's wood chip pile that is used for bleached pulp by fugitive dust from KU's coal and limestone handling operations. Basically, because of the apparent inability of the pulp producing process to effectively remove coal particles, fugitive coal emissions were the ultimate concern.

The three impact studies, conducted by Willamette, Kentucky Utilities, and NAI, used three different methodologies. The important differences in methodology were:

Study	Computer Model	Meteorology	Emission Factor
Willamette	Not used	Local	Not calculated
KU	ISC model	Evansville, IN	50% control Not a function of wind speed
NAI	ISC model	Local	0% control A function of wind speed

The KU and NAI modeling further differ in that only the inactive coal pile source was considered by NAI, while KU modeled a total of 15 sources the largest of which was the inactive coal pile. The difference in the estimated coal dust deposition predicted by the ISC model run by NAI and KU was for the most part due to the differences between the local meteorology used by NAI and the Evansville meteorology used by KU. Winds in the critical 130 to 150 degree sector are reported by Evansville about 7% of the time and by local meteorology about 15% of the time. NAI's model run thus predicted greater deposition. The Willamette analysis did not employ computer modeling of the coal dust emissions but used local meteorology to estimate the number of days per year that the wood chip pile would receive contamination from the coal storage area and based impact on various levels of assumed concentrations of coal dust.

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Neither of the studies that used air modeling showed a potential for impact from KU on Willamette's bleached pulp due to significant increases in dirt count. As explained in Section 3.2, dirt count is a function of visible particles remaining in the pulp mat after a cleaning process, and it is the quantifiable basis for pulp mat quality. The air modeling studies indicated that coal dust would not increase dirt count sufficiently to change the pulp grade. However, none of the studies was capable of assessing the potential for possible loss of brightness of the pulp mat due to the presence of subvisible particles. There is no quantitative standard for calculating tint change. There remains, although limited, a potential for degrading the pulp quality due to loss of brightness. Additional measures for coal dust emissions control are available and are discussed below.

A list of possible emission controls applicable to KU's inactive coal storage operation is given in Table 2.5-1. Data summarized in the table indicate that enclosures are among the most effective means of reducing fugitive emissions, or in this case, protecting the wood chip pile should that be considered. Power Engineering (June 1981) reports existing coal-storage barns having 23,000- to 100,000-ton capacities; dimensions reported for a 50,000-ton barn were 588-foot length and 64-foot depth. KU's proposed inactive coal storage capacity of 1.4 million tons occupying 22 acres probably could not be contained in a single barn, and space as well as cost constraints for suitable enclosures would be undesirable. Although not of the same construction as a barn, the proposed enclosure (silo) for KU's active coal storage of 16,000 tons (2 days supply at normal load) to 30,000 tons (2 days supply at full load) will cost between $3 and $4 million in 1981 dollars, according to costs reported by Power Engineering. With smaller per-unit-area cost, a reduction in planned storage capacity possibly could make barn enclosure for the inactive coal pile feasible. An alternative is to consider enclosure for Willamette's wood chip pile, which is approximately 100,000 tons. A serious drawback for enclosure of either is fire and explosion potential.

Partial enclosures or other types of wind-screening do not effectively prevent wind erosion or permit capture of the storage emissions as does total enclosure. Wind screens apparently would not be suitable to protect the wood chip pile either, since dust-ladden wind could go around or over them. Natural or man-formed land masses for controlling wind erosion of the coal pile do not appear feasible at the Hancock site. Location of the coal pile adjacent to potential wind barriers would be possible only if the pile were small enough to preclude eddying effects between the barrier and the coal.

Based on the proposed size of the inactive storage pile, chemical wetting or encrusting agents appear to be the most practical mechanisms for attaining maximum control efficiency. These agents apparently can be applied at transfer points and retain their effectiveness in subsequent storage operations. Chemical wetting agent application costs from $0.01 to $0.5 per ton, while foams cost $0.02 to $0.10 per ton. As a drawback, Power Engineering reports that water and chemical suppression may affect coal handling and burning.

As stated in EPA's preferred alternative, receipt of coal at the Hancock site is scheduled for 1988, and several years are available for advancing technology and determining mitigation. In addition to the possible measures for controlling fugitive emissions from the inactive coal storage or for protection of the wood chip pile, a means of upgrading the coal dust removal efficiency of the pulp producing process could be another alternative.

Table 2.5-1. Possible Emission Controls Applicable to Kentucky Utilities Inactive Coal Storage

Emission Points	Control Procedures	Efficiency, Percent
Loading onto piles	Enclosure	70-99
	Chemical wetting agents or foam	80-90
	Adjustable chutes	75
Movement of pile	Enclosure	95-99
	Chemical wetting agents	90
	Watering	50
	Traveling booms to distribute material	no estimate
Wind erosion	Enclosure	95-99
	Wind screens	very low
	Chemical wetting agents or foam	90
	Screening of material prior to storage, with fines (particles less than 100 microns) sent directly to processing or to a storage silo	no estimate
Loadout	Water spraying	50
	Gravity feed onto conveyor	80
	Stacker/reclaimer	25-50

Source: U.S. Environmental Protection Agency (1977). Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions. EPA 450/3-77-010.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The Hancock and Breckinridge sites and associated transmission corridors are primarily in rural surroundings that are part of a larger region containing 3 population centers: Evansville, Indiana and Owensboro and Louisville, Kentucky (Figure 3.0-1). This region is expected to contribute most of the proposed project's labor force because neither skill requirements nor sufficient workers are available in the project counties. Environmental impact, regardless of which site is developed, will be most noticeable in the 3 counties surrounding the sites (3-county project area) and moderately so in Hardin County, which contains some of the existing Elizabethtown corridor that will be widened for the Unit 2 transmission line (4-county project area).

The following sections contain summaries of existing conditions and impacts on the human environment (Section 3.1), atmosphere (Section 3.2), land resources (Section 3.3), and water resources (Section 3.4) of the project area. These and site-specific impacts are tabulated at the end of each section. The text for each section is divided into subsections that closely follow those in the Technical Appendix. Assumptions used for assessing impact to the population and socioeconomics of the project area and region are found in the Technical Appendix, along with other supporting information.

As mentioned in Section 2 of this document, site development plans for the Breckinridge site have not been pursued to the same extent as those for the Hancock site. Project-related surveys of groundwater quality have not been done on the Breckinridge site and archaeological surveys are incomplete. The USDA Soil Conservation Service survey of soil characteristics also is incomplete on the Breckinridge site. Nevertheless, most of the salient effects of the project can be estimated and significance of impact associated with each site evaluated. It sometimes is stated that effects on certain environmental elements will be the same regardless of which site is developed. This applies only to the level of detail that is known or, in some instances, appropriate.

The impact assessment addresses, to the extent practical, the proposed development of Ashland Oil's synfuel plant (H-Coal) adjacent to Kentucky Utilities proposed Breckinridge site. Location of the H-Coal facility there is a preferred alternative at present, and the Commonwealth of Kentucky has secured a purchase option on the land for synfuel development. Indications are that the human environment of the project area would be most impacted by simultaneous development of the H-Coal facility and the power plant. Further, many of these cumulative impacts will occur regardless of which site is developed for the power plant. Most of the workers will come from the same laborshed projected for the Hancock project. Additionally, because many synfuel workers are expected to commute from Perry County, Indiana and other locations west of the Breckinridge site, the impacts associated with stressed highways, housing, police protection, etc., will be felt equally in Hancock County. Thus, all adverse impacts associated with the synfuel plant will not be solely incremental to KU's Breckinridge site alternative, and beneficial impacts attributable to KU will be overshadowed by the larger project (5000 peak construction work force and up to 1500 operators).

There are 9 energy projects proposed or underway in the general area of the Hancock project area - 6 projects between the Breckinridge site and Evansville and 3 others within 30 miles of Evansville. Concurrent or overlapping

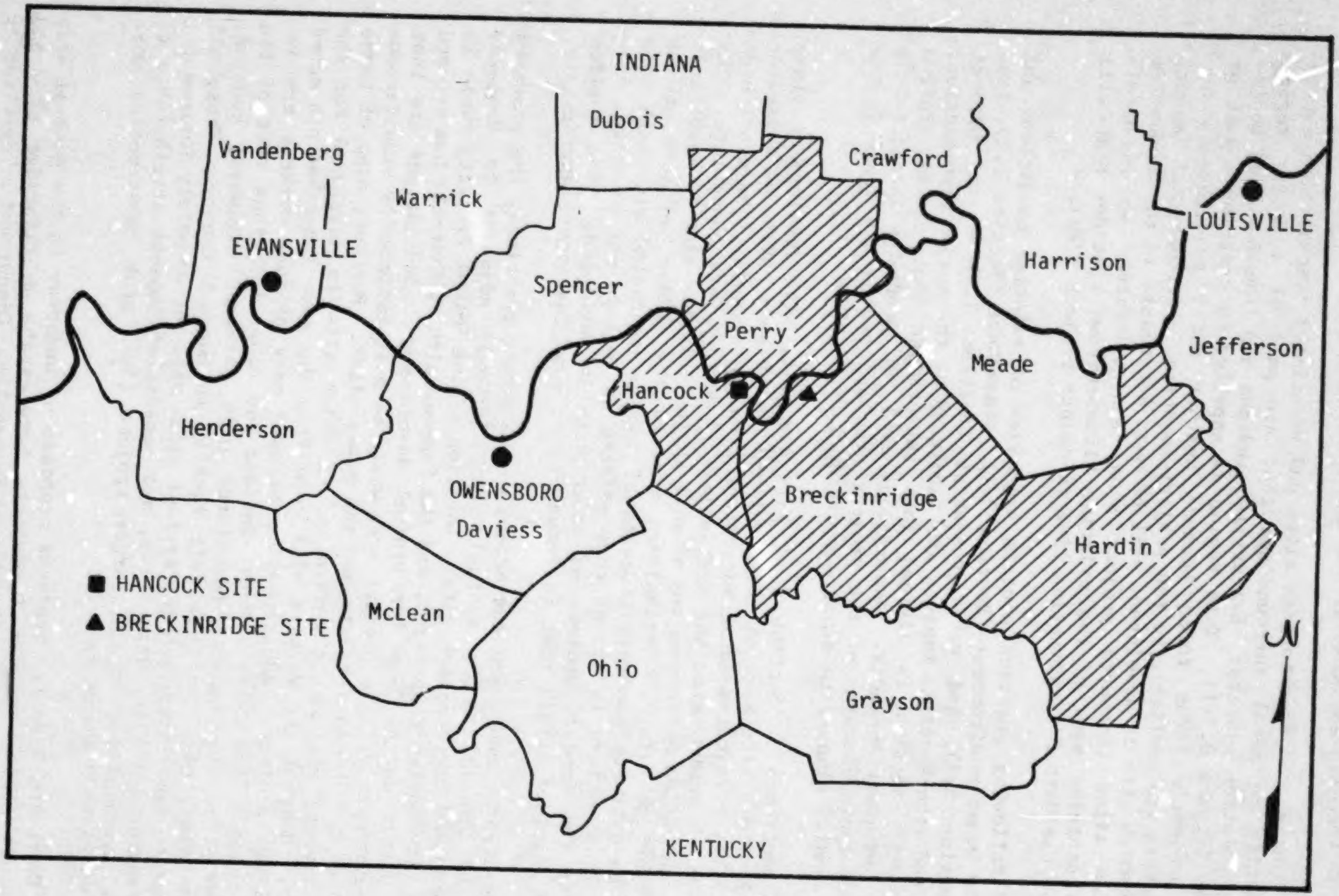

INDIANA
Dubois
Vandenberg
Warrick
Crawford
EVANSVILLE
Spencer
Harrison
LOUISVILLE
Perry
Meade
Jefferson
Hancock
Henderson
OWENSBORO
Daviess
Breckinridge
Hardin
■ HANCOCK SITE
▲ BRECKINRIDGE SITE
McLean
Ohio
Grayson
N
KENTUCKY

Figure 3.0-1. Region of the Hancock and Breckinridge Sites and the 4-County Project Area

development of all would require a peak construction work force in 1986 of more than 26,000. Only in 19[illegible] will the Hancock project require a significant part (12%) of the combined construction needs.

3.1 HUMAN FACTORS

Because industrialization is ongoing in the lower Ohio River Valley, contractors, skilled labor, and materials necessary to support the Hancock project are available in the region. This means that construction of the proposed power plant and transmission system will not unduly strain the regional economy and socioeconomic infrastructure. However, competing development may slow response to KU's relatively small labor demand. Further, the communities in the immediate vicinity of the Hancock and Breckinridge sites do not have services or facilities adequate to deal with a major population influx. Thus, many of the actual impacts to the human environment of the area will depend, in kind and magnitude, on the response of the regional labor force to the demands of the projects.

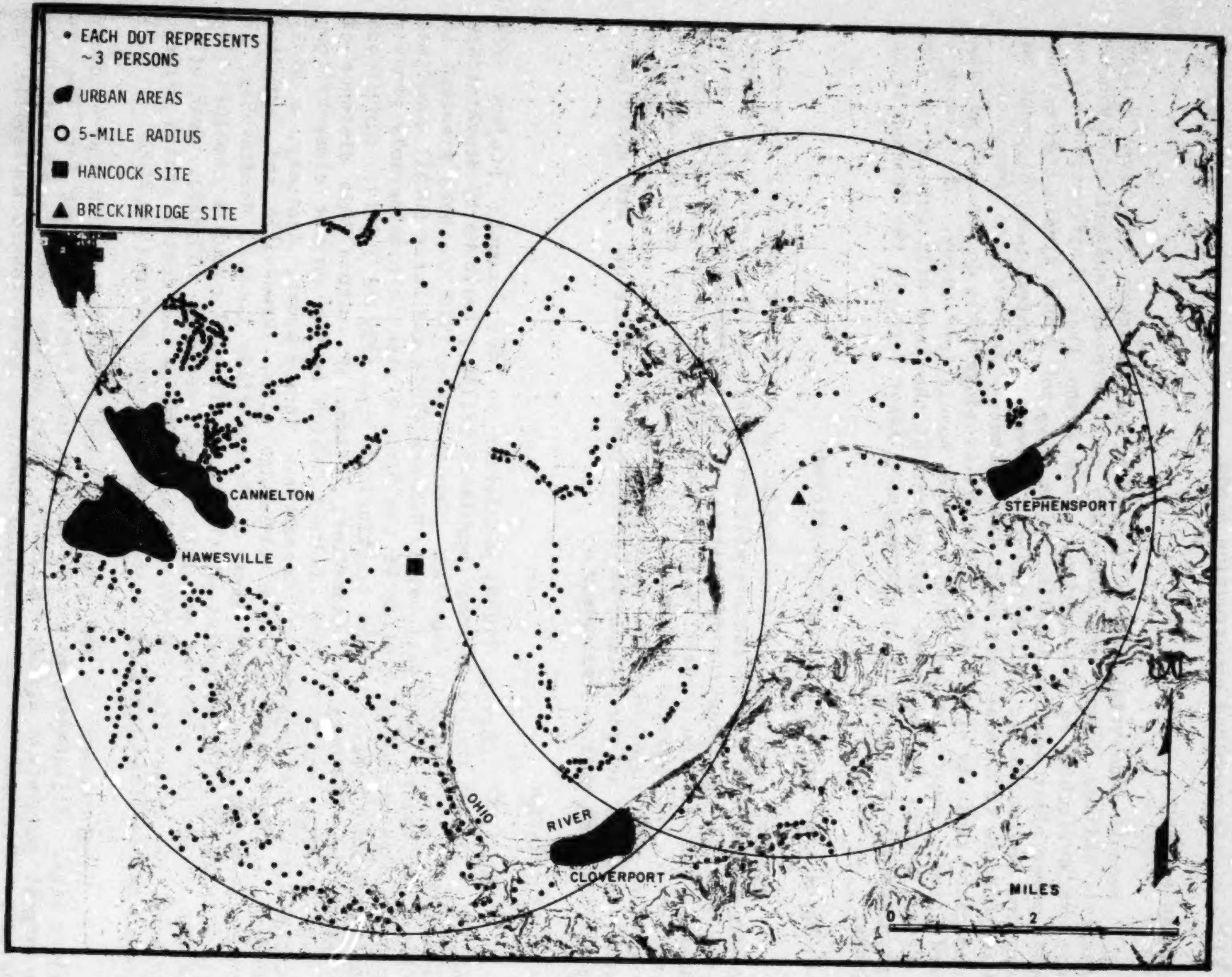
3.1.1 Population and Socioeconomic Conditions

Project-related population changes of sufficient magnitude to noticeably affect community infrastructure will occur only in the 3 counties surrounding the Hancock and Breckinridge sites. Unlike population changes, socioeconomic effects of the project will be more regional in nature since most of the work force is expected to commute and substantial ($57 million) materials and services are projected to be purchased from regional suppliers. No distinguishable changes in population or socioeconomic conditions are anticipated from transmission system development.

3.1.1.1 Population

Baseline. Current (1980) population in the 3-county project area is 43,783. Hancock County is least populated (7,710), followed by Breckinridge (16,862) and Perry (19,211) counties. Growth since 1970 has been greatest in Breckinridge County (14%), followed by Hancock (10%) and Perry (0.5%) counties. Population density within 5 miles of the Hancock site is considerably greater than that within 5 miles of the Breckinridge site (Figure 3.1-1). Cloverport and Hawesville, Kentucky and Cannelton, Indiana are within this distance of the Hancock site, and Tell City, Indiana, which is the largest close-by town to either site, is adjacent to Cannelton. Stephensport, Kentucky, a small community, is just east of the Breckinridge site. Hawesville and Cannelton are county seats; the county seat of Breckinridge County, Hardinsburg, is about 22 highway miles southeast of the site. These 3 counties combined have less than 1/10 the combined populations of Owensboro (53,839), Evansville (129,665), and Louisville (298,161). Louisville is the center of the largest Standard Metropolitan Statistical Area (SMSA) in the region (906,240).

Hardin County is the most populated (69,000+) within the 4-county project area. Elizabethtown is the largest town (14,000+), but Fort Knox is the largest population center (37,000+). Most of the county's population is located in Elizabethtown and locations north of there toward Louisville, so that population density in the western part of the county containing the Elizabethtown corridor is characteristic of rural areas and similar to that in the 3-county project area.



• EACH DOT REPRESENTS ~3 PERSONS
URBAN AREAS
O 5-MILE RADIUS
■ HANCOCK SITE
▲ BRECKINRIDGE SITE
CANNELTON
HAWESVILLE
STEPHENSPORT
OHIO
RIVER
CLOVERPORT
MILES
0
2
4

Figure 3.1-1. Residential Density Within 5 Miles of the Hancock (left circle) and Breckinridge (right circle) Sites

The project area and especially the sites are readily accessible by railway (Louisville and Nashville) and waterway. Road access to the Hancock site is via U.S. 60 and KY 1406. KY 144 leads to the Breckinridge site from U.S. 60 and from the north. Westward, U.S. 60 goes to Owensboro, and eastward it goes to Fort Knox and then north to Louisville. The only four-lane stretches are between Hawesville and Lewisport and between Fort Knox and Louisville; otherwise the highway is relatively difficult to travel, winding through rugged terrain and frequently congested during peak travel periods. KY 86 goes eastward off U.S. 60 to Elizabethtown and provides access to that part of the Elizabethtown corridor not accessed via U.S. 60. An alternative route to the sites is I-64 westward from Louisville through southern Indiana. Indiana Route 37 southward from there to Tell City is newly upgraded but the single river crossing in the 3-county project area - Cannelton to Hawesville - will be a point of significant congestion during power plant construction. Large-scale air services are limited to Louisville, although Evansville and Owensboro have smaller commercial facilities. Tell City has interstate trucking service and local bus lines service most of the project area towns.

Housing availability in the 3-county project area reflects population migration characteristics, including little transience and turnover. Housing starts have decreased recently, the rental market is limited (quantity and quality), and there are fewer than 100 motel units in the vicinity of the sites, including those in Tell City. Mobile homes have become popular but no trailer parks exist. As indicated by relatively small population growth, most of the 3-county project area is still experiencing moderate to significant outmigration that began when the river port boom ended. The closest towns with much available housing are Owensboro and Elizabethtown.

Impacts. It is expected that somewhat more than 80% of the Hancock project construction work force will commute. Inmigration will be limited, so that during the period 1982 to 1994, inmigrants attributable to the Hancock project will increase population of the 3-county project area a maximum of 1.6% over current population (Table 3.1-1). The greatest increase will occur in 1992, when inmigrant construction workers and operating personnel and dependents are expected to be more than 700. Somewhat lesser increases will occur in 1987-88, associated with construction workers only, and in 1991 and 1993. After 1994, operation inmigrants will permanently increase current area population size by approximately 0.7%. It is expected that adequate numbers of potential workers are available in the 3 counties to provide an indirect work force sufficient to supply goods and services for the temporary and permanent inmigrants.

Assuming greater inmigration will occur in the county of project development, Hancock County will experience relatively greater growth than the other counties should the power plant be built there because it is the least populated county. Projected population growth in Hancock County from 1980 to 1990 is 6% without the project, which is less than Kentucky as a whole. Should the plant be constructed in Breckinridge County and many inmigrants desire to live in Cloverport near the plant, the town's population could increase significantly because most of the county population is near Hardinsburg and eastward.

Housing demands of temporary and permanent inmigrants apparently can be met, except for a shortfall of rental units in Hancock County. A greater problem could be the adequacy of motel and other temporary housing units in the project area. At present, owners indicate about 50% occupancy of available units, but expected transient construction personnel, visiting equipment installers, inspectors, etc. will exceed available capacity. The ability of Owensboro to offset shortfalls of permanent and temporary housing demand will be substantially reduced by development of other proposed projects. Development of the H-Coal project would induce construction of permanent and temporary units but, prior to balance of supply and demand, competition for available units would be great and prices would escalate significantly.

Existing rail, barge, and other commercial transportation is not expected to be impacted by the Hancock project. Neither is impact expected on road transportation due to the transmission facilities. However, as indicated above, poor traveling conditions on U.S. 60 are expected to worsen considerably because of increased auto traffic. As in the case of housing, road construction probably would be induced by H-Coal development but there could be a period of major impact prior to upgrading.

3.1.1.2 Socioeconomic Conditions

Baseline. Perry and Hardin counties have long-established and diverse industrial bases. Hancock County recently has expanded its industrial base to account for most of its economic activity and make it the leader in per capita and median household income. Industrial diversity there is still less than in Perry County, but greater than in Breckinridge County, where industrial activity remains limited. The two largest industrial employers in the project area are Southwire companies in Hancock County and William Tell companies in Perry County. Unemployment is high in Perry and Hancock counties (10.3 and 8.1% in 1978) and about at the national average in the others.

In line with their diversified industrial base, Perry and Hardin counties have the highest per capita retail sales. Retail sale activity in Hancock County is out of line with industrial activity, with per capita sales 1/2 and total volume 1/4 that of Breckinridge County. Retail sales and agriculture each account for more than 30% of Breckinridge economic activity.

Only in Hancock County is income generated greater than income received, indicating significant commuting to the county. Income generated in Breckinridge is far less than that received by the residents ($28.6 million versus $81.4 million), indicating a large work force commuting to other counties. Similarly, 1000 workers commute from Perry County to others, especially to Hancock County.

All of the Kentucky counties of the project area (where the power plant and transmission facilities will most increase tax bases) enjoy favorable balances between revenues and expenditures. To offset revenue loss because of the relatively large number of nonresident workers, Hancock County has a 1% occupational tax. County and municipal services provided by taxes in each county (police, water, sewage treatment, etc.) generally are adequate for the current population but some are only marginal. Schools in Hancock and Hardin counties have student/teacher ratios somewhat above the Commonwealth average, while that in Breckinridge County is somewhat lower. The status of government services in Perry County, which will be affected during project construction, is similar to that of the Kentucky counties; student/teacher ratio is lower than the Indiana average.

The demand for social services among the project area counties is generally high. The level of services correlates somewhat with the overall level of economic development, with Breckinridge County indicating the greatest need.

People in Perry, Breckinridge, and Hancock counties tend to have a strong sense of community and attachment to their land and lifestyle. Similar attachment is weaker in Hardin County with its larger military and suburban populations. Much of the effort to attract industrial development to the three smaller counties is motivated by a strong desire to maintain economic viability so that people are not forced to leave in order to survive. Industrialization, in turn, has led to an influx of new residents, which is perceived as an acceptable tradeoff necessary to viability. There is, however, a careful weighing of industrial benefits versus lost opportunities associated with development, and the communities (especially Hancock and Perry counties) are quite selective in their solicitations.

Impacts. Maximum direct employment for the Hancock project probably will occur during 1992, with a total of about 1046 jobs (916 construction workers, 130 operators) and direct salaries and wages of $84 million (Table 3.1-1). Within the 17-county laborshed, the number of prospective workers represents 0.15% of the total labor force in 1978, 3.2% of those unemployed, and 6.5% of the estimated construction labor pool of 16,000 (estimated by applying state construction worker percentages to each county's labor force). The construction work force required during 1992 exceeds the approximately 875 unemployed construction workers in the region in 1978, as does the peak construction work force required in 1987-1988 (981 workers). In all other project years the required work force could theoretically be obtained within the region. The peak years could offset regional unemployment significantly, although skill requirements could reduce the offset somewhat. Competing projects may not seriously impact labor availability for the Hancock project, but the proposed pattern of development emphasizes the importance of the Louisville area as a labor source and de-emphasizes the potential importance of Owensboro and Evansville.

The peak direct income projected for the Hancock project in 1992 represents an increase of 0.3% in regional income over what would be expected without the project. Secondary employment and income resulting from the project is projected to accrue on the basis of one indirect job for each direct job and 90% of the income. The peak combined income from both direct and indirect Hancock project employment will be $167.5 million in 1992; this will represent about 0.5% of the total regional income.

For projecting regional and project area socioeconomic effects, a constant contribution of construction labor was assumed:

4-county project area (Hancock, Breckinridge, Hardin and Perry counties)	28%
Jefferson County, Kentucky (Louisville)	42%
Daviess County, Kentucky (Owensboro)	8%
Other Kentucky counties	9%
Vanderburg County, Indiana (Evansville)	9%
Other Indiana counties	3%

Additionally, as mentioned previously, greatest immigration is expected to occur in the county of development, so that sources of effects basically are flip-flopped between Breckinridge and Hancock counties when each alternative is considered (Table 3.1-1).

The peak direct income from the project under the Hancock alternative will increase projected 1992 effective buying income (EBI: income after taxes, contributions, fines, fees, legal penalties) in that county by 4.4% ($7.8 million). Adding 90% induced income from the project would increase that to about 8%. Significant increases will not be noticed until 1986, peaks will occur in 1988 and 1992, and then direct project EBI will level off at about 2.25% of the county total from 1995 through the life of the project, if no other changes in the economic structure occur. Per capita income will not be raised significantly during operation because the average project-related EBI is expected to be the same as the projected average EBI in the county without the project.

Under the Breckinridge alternative, direct income will increase projected 1992 Breckinridge County EBI by 2.5%. Direct project EBI during operation of the plant will represent 1.2% of county EBI. The significance of the project on the Breckinridge site is that it will increase projected average EBI in that county for the life of the plant. Further, the project would create jobs in a sector of the economy that currently is small.

Because most structural materials for the project will be purchased outside the region, and because the project is not expected to induce satellite industry, benefits to regional industry will not be widespread. Effects on agricultural activity also will be localized and dependent on plant site. Unlike industry and agriculture, however, businesses in both the region and project area will benefit to a certain extent, based on work force distribution and availability of support functions. Total potential expenditures in the 17-county laborshed could be as much as $233.33 million during construction, exclusive of any expenditures for heavy equipment and construction materials. The secondary effects of these expenditures can be assumed to be the generation of an approximately equal number of indirect dollars.

The 4-county project area may receive as much as $117.62 million of direct expenditures. Patterns of dispersal are expected to follow present ones (e.g., more retail sales will occur in Perry and Hardin counties) since the project is not expected to alter distribution of goods and services. Concurrent development of the H-Coal facility, however, would probably lead to additional business establishment in Hawesville as well as in Cloverport and alter shopping patterns.

Taxes from the project are expected to eventually sustain public costs associated with it, but there may be a lag of several years between need for and receipt of additional revenues. The relative increase in local property taxes resulting from this project would be more significant in Breckinridge than in Hancock County because Breckinridge relies more heavily on property taxes for total revenue; other tax impacts that would occur at the state and Federal levels would be comparable.

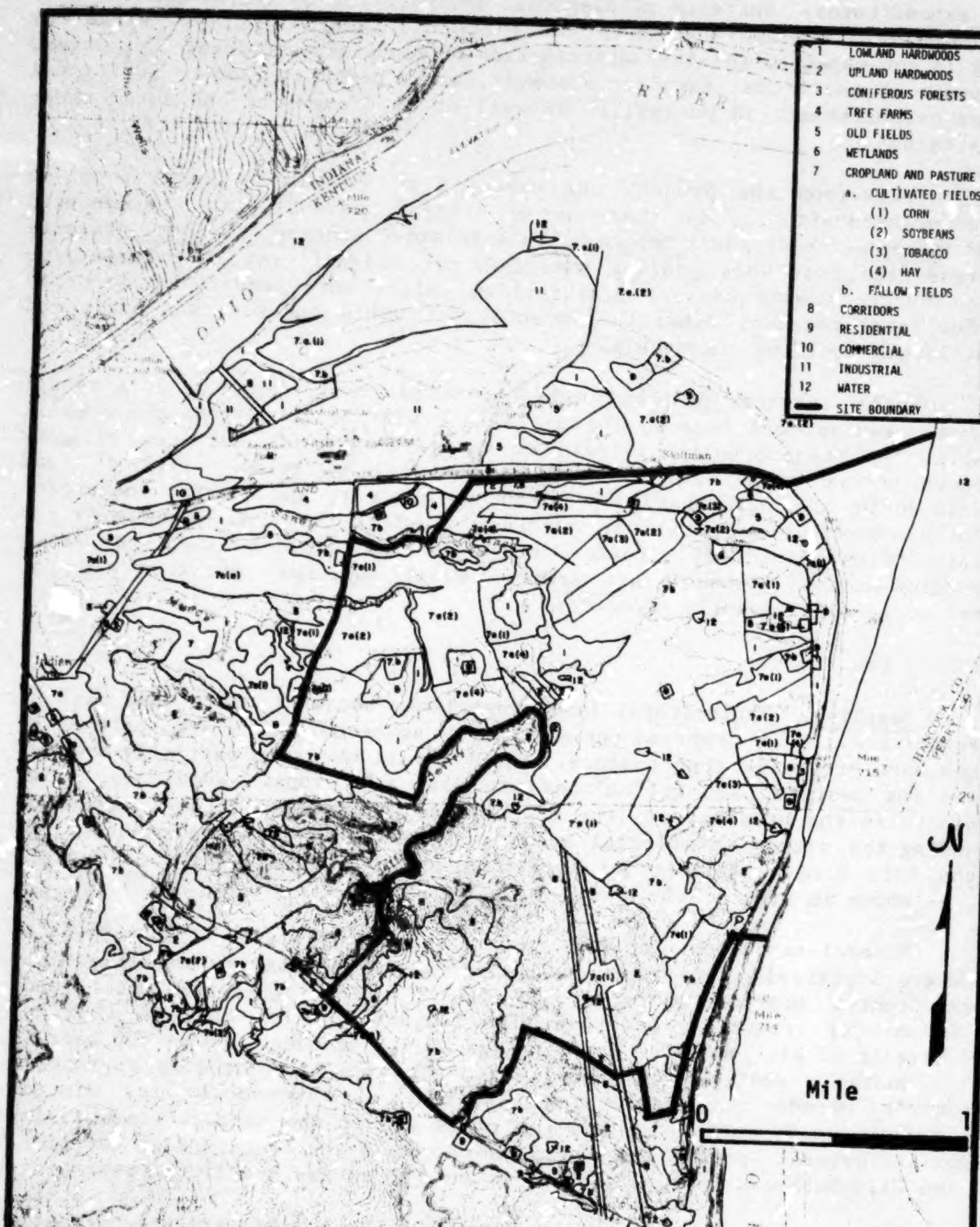
Social services probably will not be adversely impacted as a result of the proposed project because the net effect will be to improve the overall economy in the project area. Strain on emergency medical services will be reduced by onsite first aid. However, there will be greater risk of road accidents during the construction phase of the project, and traffic congestion could slow access to hospitals in Hardinsburg, Tell City, and Owensboro for accident victims and others. Police protection also could be impacted during construction unless personnel are added. Other municipal services are not expected to be significantly affected.

3.1.2 Land Use

Baseline. Agricultural land comprises somewhat more than 1/3 of the project area, with cropland (predominantly soybeans, much corn, patches of tobacco) more extensive than pasture. Hilly locations, some partially wooded, are used for pasture, and bottomlands are used for crops. Woodlands, which predominate in the uplands, are the most extensive land use in the 3 counties surrounding the sites. Commercial and industrial activities are concentrated near the Ohio River. Residential locations tend to extend inland and up the hills, as shown in Figure 3.1-1.

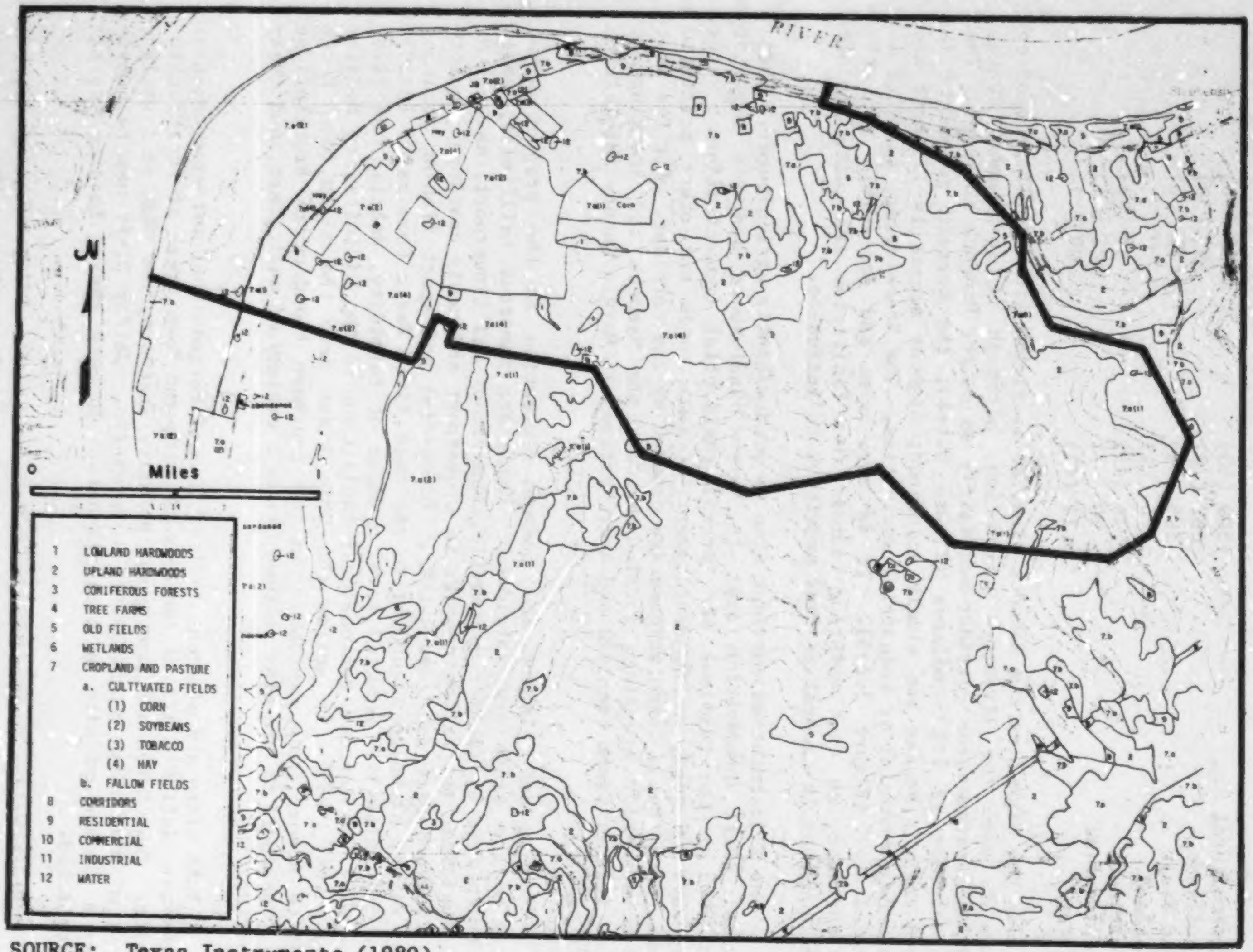
Mineral resources include coal, petroleum, shales, and clays in Hancock and Breckinridge counties and stone (shale, sandstone, and limestone) in Perry County. Hancock County, on the edge of Kentucky's Western Coal Field, leads in mineral resource production with 122,356 tons of coal in 1978 and 66,488 barrels of oil in 1979. Breckinridge County produces 300 to 500 barrels of oil a month; a small newly opened strip mine south of McQuady represents the county's recent coal production. Neither site presently has mineral activity, but two producing oil and gas pools are in the Hancock transmission corridor and several secondary recovery pools are in the Breckinridge corridor. Along the Elizabethtown corridor, there is no oil or gas and little quarrying.

Reflecting their proximity to the river, both sites are predominantly agricultural (Figures 3.1-2 and 3.1-3):


1 LOWLAND HARDWOODS
2 UPLAND HARDWOODS
3 CONIFEROUS FORESTS
4 TREE FARMS
5 OLD FIELDS
6 WETLANDS
7 CROPLAND AND PASTURE
a. CULTIVATED FIELDS
(1) CORN
(2) SOYBEANS
(3) TOBACCO
(4) HAY
b. FALLOW FIELDS
8 CORRIDORS
9 RESIDENTIAL
10 COMMERCIAL
11 INDUSTRIAL
12 WATER
SITE BOUNDARY
OHIO
RIVER
INDIANA
KENTUCKY
Mile 720
Stallman
Mile 715
HANCOCK CO.
PERRY CO.
N
Mile
0
1

SOURCE: Texas Instruments (1980)

Figure 3.1-2. Land Use/Land Cover, Hancock Site, 1979



RIVER
0
Miles
1
1 LOWLAND HARDWOODS
2 UPLAND HARDWOODS
3 CONIFEROUS FORESTS
4 TREE FARMS
5 OLD FIELDS
6 WETLANDS
7 CROPLAND AND PASTURE
a. CULTIVATED FIELDS
(1) CORN
(2) SOYBEANS
(3) TOBACCO
(4) HAY
b. FALLOW FIELDS
8 CORRIDORS
9 RESIDENTIAL
10 COMMERCIAL
11 INDUSTRIAL
12 WATER
Corn
abandoned

SOURCE: Texas Instruments (1980)

Figure 3.1-3. Land Use/Land Cover, Breckinridge Site, 1979

Land Use/ Land Cover	Acres (% of Total) Hancock	 Breckinridge
Agricultural	1509 (65)	1430 (58)
Woodlands	662 (28)	959 (38)
Old Field	105 (5)	52 (2)
Wetland	4 (<1)	0
Corridors	14 (<1)	8 (<1)
Residential	20 (1)	22 (1)
Water	11 (<1)	23 (1)

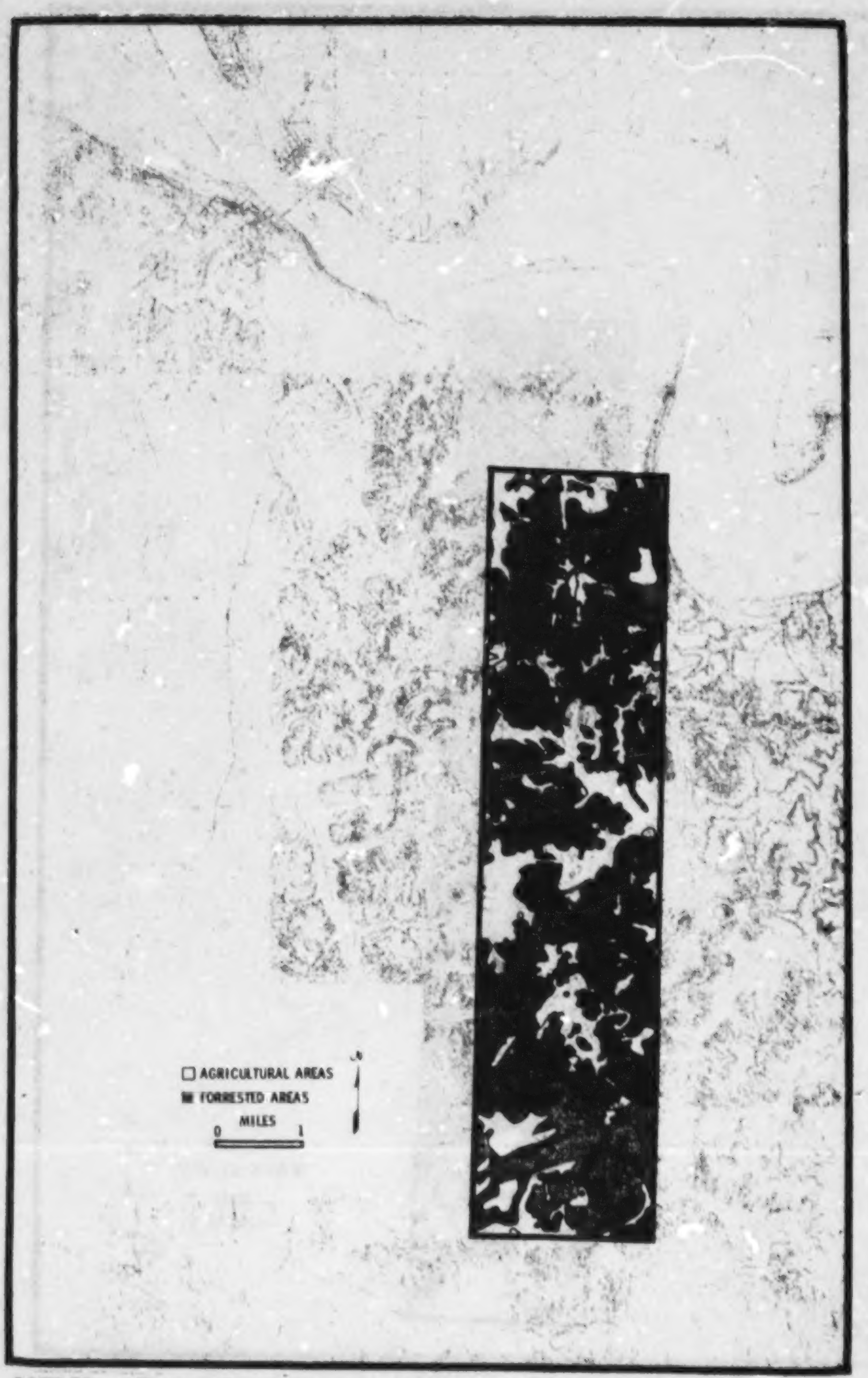
Crop yields are higher on the Hancock site, as is timber yield. Little land on the sites is used for livestock production, although it is common on the Breckinridge transmission corridor and fairly so on the Hancock corridor. The Hancock corridor is 78% woodlands (Figure 3.1-4); the terrain generally is hilly and rugged; houses are widely scattered; highway access is limited; and there are no commercial or industrial activities. The Breckinridge corridor is 40% agricultural (Figure 3.1-5). It is more open and accessible than the Hancock corridor, so that existing transmission facilities are quite visible and the landscape in general is less sensitive to intrusion.

The Elizabethtown corridor also is predominantly agricultural. There are several small communities near it, with Hardinsburg and the edge of Elizabethtown at the terminus the largest residential concentration. Entry from highways is good, as is development of farm roads and other proximate accesses. More than a dozen streams are crossed by the corridor, with the most sensitive water-body crossings located between the Hancock and Breckinridge corridors (Clover Creek complex) and near Vertrees in Hardin County (Hicks Lake wetlands complex).

Hunting and fishing are common recreation in the project area, including on the sites and corridors. There are numerous ballfields, small parks, and picnic areas near Hawesville, Cannelton, and Cloverport, as well as a large municipal recreation complex in Cloverport and newly developed, multipurpose Vastwood Park near Hawesville. Commercial and sport fishing occur on the Ohio River, although according to the Ohio River Basin Commission (ORBC), both are 50% below the expected level because of turbidity, debris, and river traffic. The two largest recreational facilities in the vicinity are Hoosier National Forest, which is across the Ohio River from the sites, and Rough River State Resort Park, which is on the southern boundary of Breckinridge County. Owensboro is the closest town having a variety of music, art, and theater opportunities.

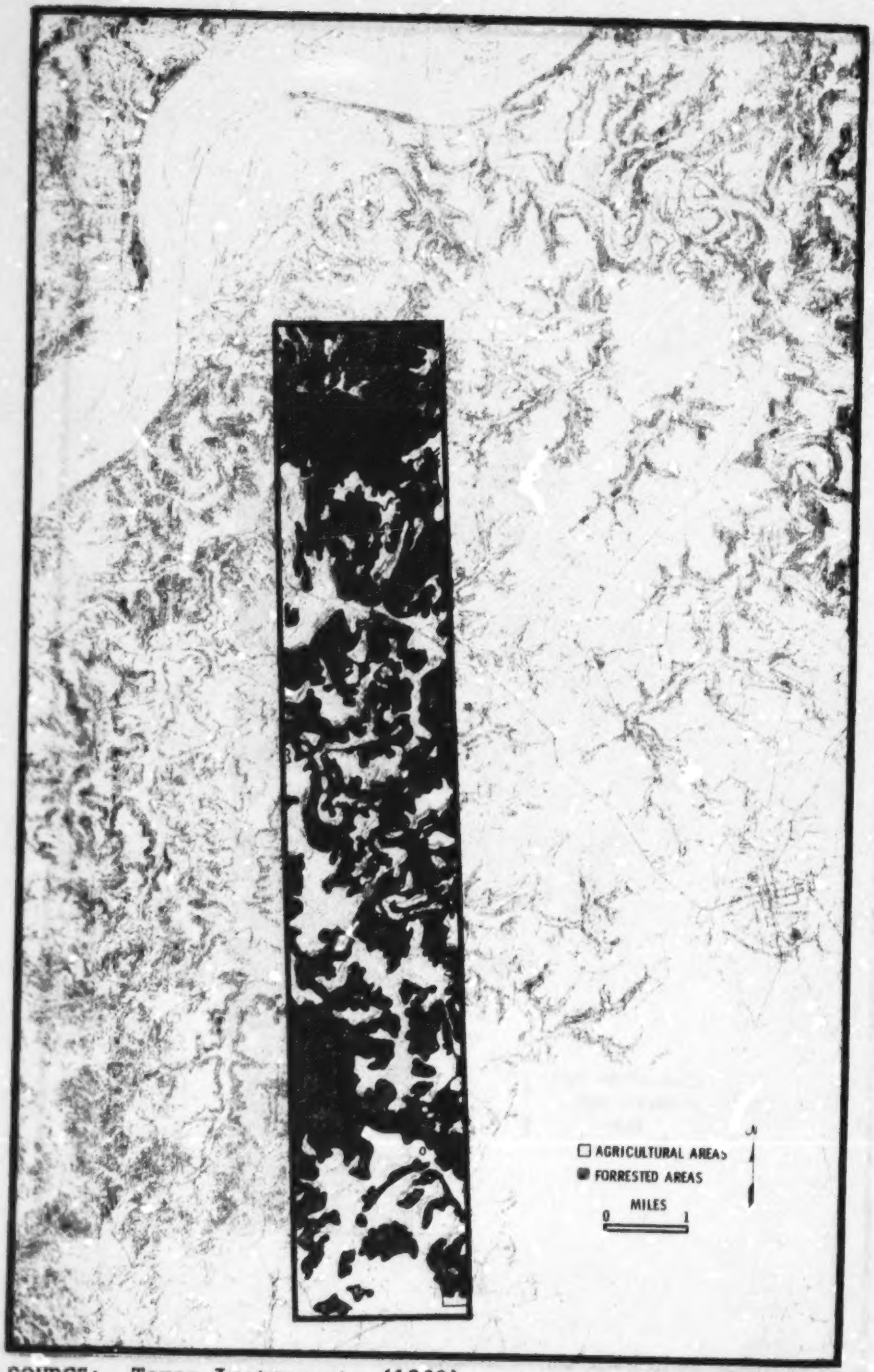
Both sites are adjacent to locations of recreational and environmental significance: Jeffry Cliff at the Hancock site and Town Creek at the Breckinridge site. Town Creek has been given priority status by the ORBC as a wetland embayment of sufficient significance to preserve. Jeffry Cliff has been proposed as a recreation site by area planners. In both cases, funding has not been identified.

Breckinridge County is in Kentucky's Lincoln Trail Area Development District (ADD), while Hancock County is in the Green River ADD. Hancock County has an Urban Planning Commission, which has instigated zoning only in


☐ AGRICULTURAL AREAS
■ FORRESTED AREAS
MILES
0
1

SOURCE: Texas Instruments (1980)

Figure 3.1-4. Agricultural Land Use, Hancock Transmission Corridor, 1979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SOURCE: Texas Instruments (1980)

Figure 3.1-5. Agricultural Land Use, Breckinridge Transmission Corridor, 1979

Hawesville and Lewisport. Perry County has countywide zoning and subdivision rules. Breckinridge County has no zoning. In cooperation with various ADDs and other agencies, The Kentucky Department of Commerce has designated low, level locations in the project area, including those on both sites, as potential industrial land.

Impacts. The project will expand industrial land use and preempt agricultural and woodland land use primarily (Table 3.1-1). Impact to the recreational potential of Town Creek embayment should be temporary from activity associated with constructing the generating station. Impact to Jeffry Cliff recreational potential would be long-term because the plant site virtually surrounds currently used access points. Impacts to mineral resource potential along either corridor probably can be avoided by appropriate center line placement, although this will be more difficult, in consideration with other aspects of ROW alignment, on the Hancock corridor. The project is not expected to significantly expand or create new residential land use in any of the project area counties because relatively few permanent inmigrants are anticipated. Cloverport and/or the residential area between Hawesville and Lewisport are expected to increase somewhat.

3.1.3 Cultural Factors

3.1.3.1 Visual Resources

Baseline/Impacts. Both the Hancock and Breckinridge sites are consistent with the landscape continuity of their geographical setting in that both are characteristic of Ohio River valley lowlands in western Kentucky. Aesthetic differences between the 2 sites are generally due to variations in extent and location of contrasting landforms, visual boundaries, and adjacent land use. The Hancock site, with Jeffry Cliff (Figure 3.1-6), riparian vegetation associated with 3 streams, and a greater extent of gently rolling topography, has greater visual contrasts and diversity than does the Breckinridge site (Table 3.1-1). It also is in view of U.S. 60, Indiana route 66 across the river, and Kentucky route 1406 (Figure 3.1-7). In contrast, much of the Breckinridge site is not visible from Kentucky route 144 (Figure 3.1-8) and none can be seen from U.S. 60 or from a major road in Indiana. Croplands and woodlands on the Breckinridge site form large blocks, so that the site generally lacks the mosaic pattern created by the 3 streams and other forms on the Hancock site. The most incompatible land use is the paper plant adjacent to the Hancock site.

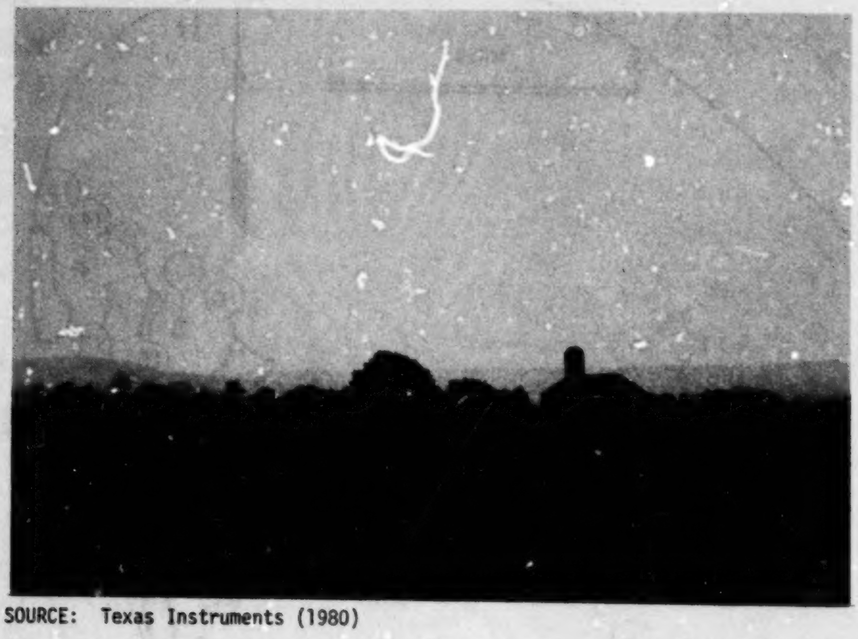
The Hancock transmission corridor exhibits a continuity of wooded ridges with limited visual contrast. Visibility of the corridor is limited to a few roads, and except for areas cleared for farming, the landscape is relatively undisturbed. The Breckinridge corridor, like the Hancock site, has scattered ridgetops that provide broad vistas of farmlands. Visibility is high because of the amount of farmland and number of roads. Existing transmission lines in the Hancock corridor are generally screened by woods, whereas those in the Breckinridge corridor are clearly seen. Landscape of the Elizabethtown corridor is mostly gently rolling hills and valleys, with one rugged area southeast of Cloverport providing the most contrasting landforms.

SOURCE: Texas Instruments (1980)

Figure 3.1-6. View of Jeffry Cliff, 1980 (from Hwy. 1406)

SOURCE: Texas Instruments (1980)

Figure 3.1-7. View of Jeffry Cliff, 1980 (from Skillman Road)



SOURCE: Texas Instruments (1980)

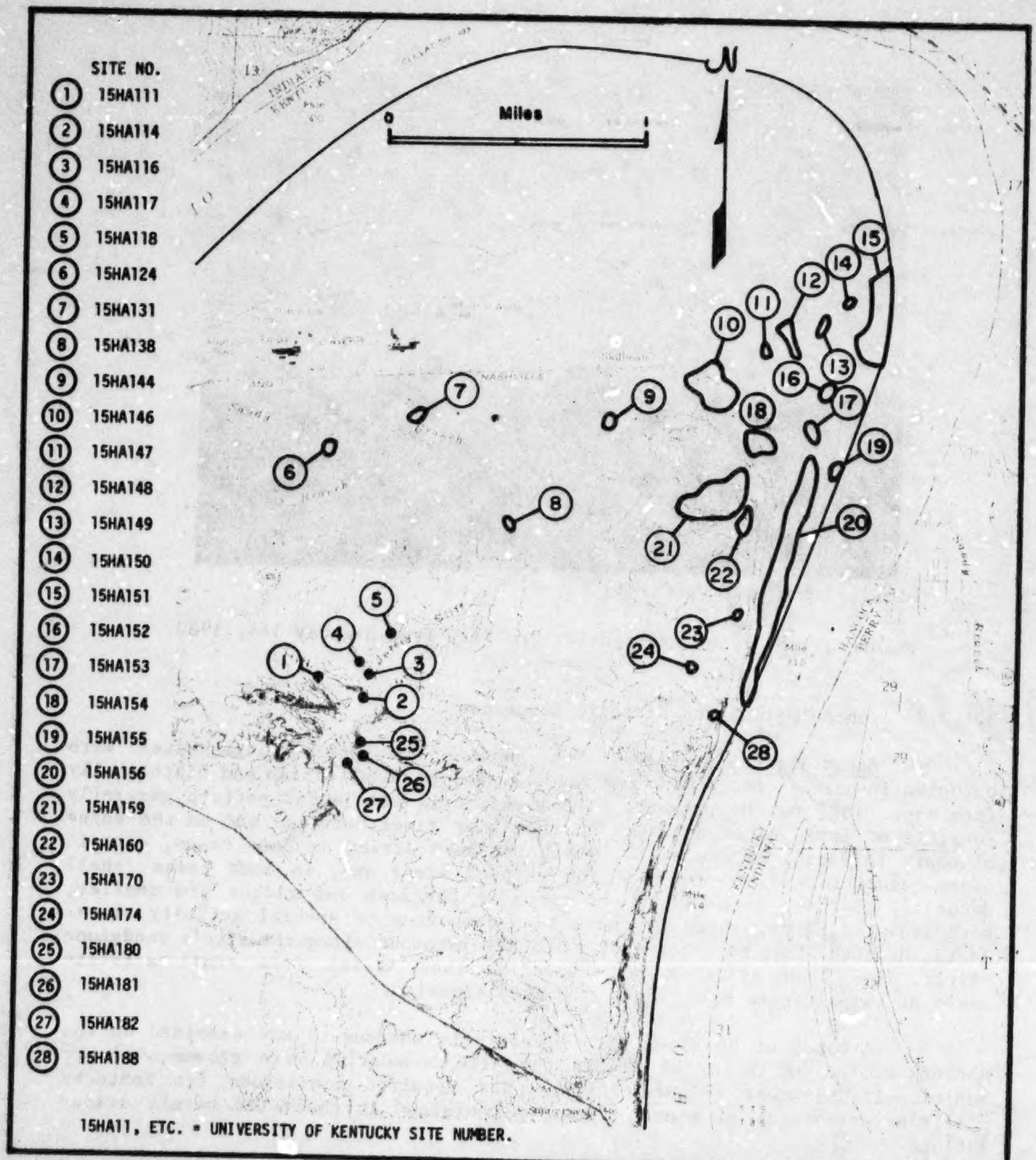
Figure 3.1-8. View of Breckinridge Site from Highway 144, 1980

3.1.3.2 Archaeological and Historic Resources

Archaelogical Baseline. The Hancock and Breckinridge sites were occupied in prehistoric times from Paleo-Indian to Mississipian and historically from about 1807 to the present. The prehistoric settlement pattern generally consists of large sites situated on the lower river terraces and on the edges of upper terraces. These sites, which may have served as base camps, contain dense quantities of burned rock and chipped stone and, in some cases, shell deposits. Farther from the river on upper terraces and ridges are smaller, more isolated sites, which may have been campsites or special activity areas. On the Hancock site, rockshelters, which are numerous along the site's sandstone cliffs, also show evidence of occupation that varied from small activity areas or campsites to base camps with deep deposits.

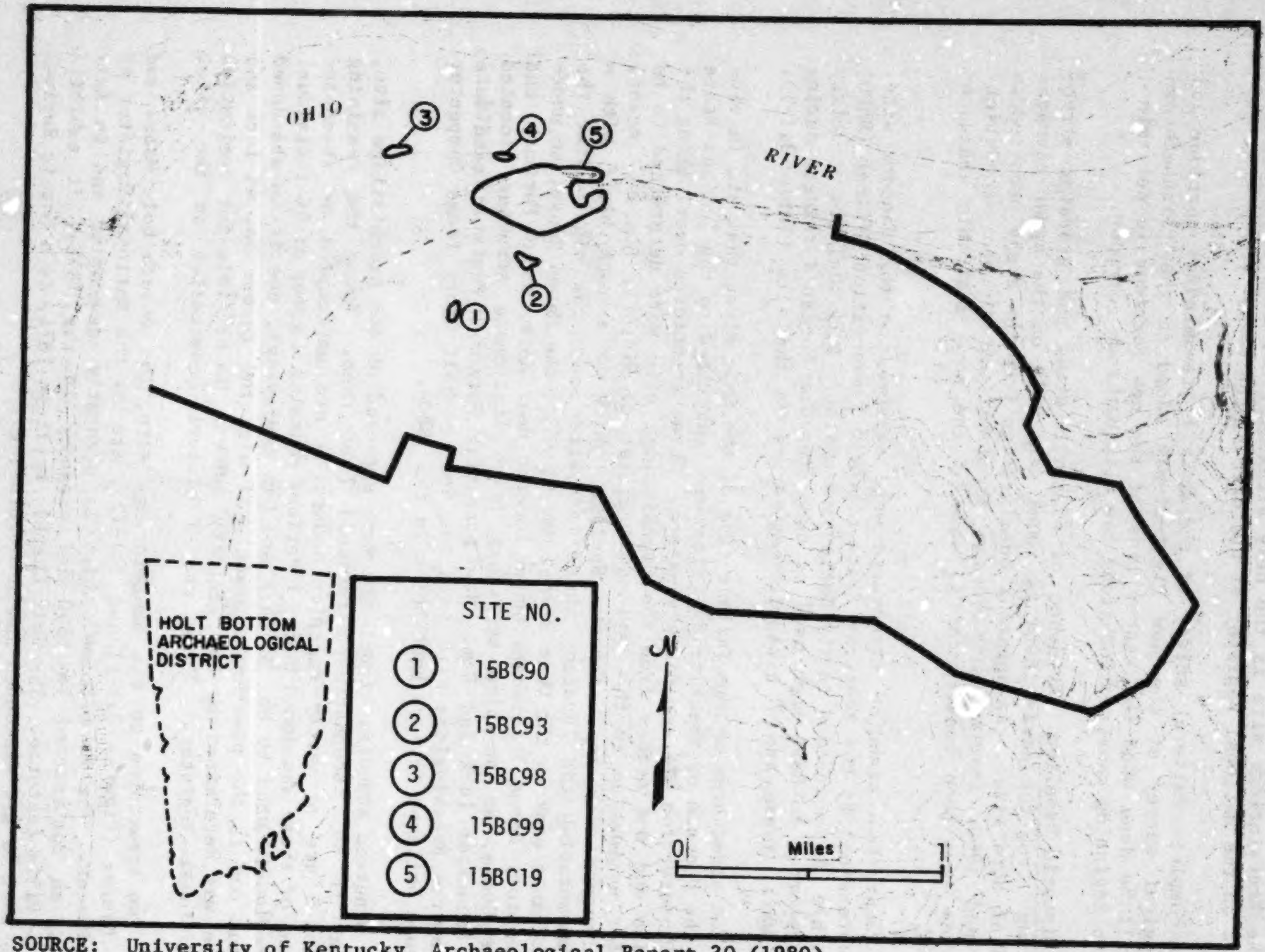
A total of 95 sites with prehistoric components was examined on the Hancock site. Of these, 28 within the site boundaries were recommended for additional assessment (Figure 3.1-9). The required conditions for Kentucky Utilities assessment of these sites are contained in the NPDES permit tipulations.

On the Breckinridge site, 68 archaeological sites (two of which had been previously documented) were surveyed and 15 were recommended for further study. A change in the proposed boundaries on the Breckinridge site eliminated 10 of these 15 prehistoric sites from KU's construction area (Figure 3.1-10). Other prehistoric sites may exist in portions of the revised Breckinridge site


SITE NO.
① 15HA111
② 15HA114
③ 15HA116
④ 15HA117
⑤ 15HA118
⑥ 15HA124
⑦ 15HA131
⑧ 15HA138
⑨ 15HA144
⑩ 15HA146
⑪ 15HA147
⑫ 15HA148
⑬ 15HA149
⑭ 15HA150
⑮ 15HA151
⑯ 15HA152
⑰ 15HA153
⑱ 15HA154
⑲ 15HA155
⑳ 15HA156
㉑ 15HA159
㉒ 15HA160
㉓ 15HA170
㉔ 15HA174
㉕ 15HA180
㉖ 15HA181
㉗ 15HA182
㉘ 15HA188
15HA11, ETC. = UNIVERSITY OF KENTUCKY SITE NUMBER.
Miles
0
1
N
INDIANA
KENTUCKY
KENTUCKY
INDIANA

SOURCE: University of Kentucky, Archaeological Report 30 (1980)

Figure 3.1-9. Significant Archaeological Sites, Hancock Site, 1980


OHIO
RIVER
HOLT BOTTOM
ARCHAEOLOGICAL
DISTRICT
SITE NO.
① 15BC90
② 15BC93
③ 15BC98
④ 15BC99
⑤ 15BC19
N
0
Miles
1

SOURCE: University of Kentucky, Archaeological Report 30 (1980)

Figure 3.1-10. Significant Archaeological Sites, Breckinridge Site, 1980

that were not included in the cultural survey (approximately 850 acres), although most of these acres are uplands. The Holt Bottoms Archaeological District south of the Breckinridge site is the only archaeological site in the project area that is on the National Register of Historic Places.

A complete cultural survey of the Unit 1 transmission corridor and an archaeological survey of the new right-of-way added to the Elizabethtown corridor will be done when the center line of the new corridor is determined and prior to beginning construction along the Elizabethtown corridor.

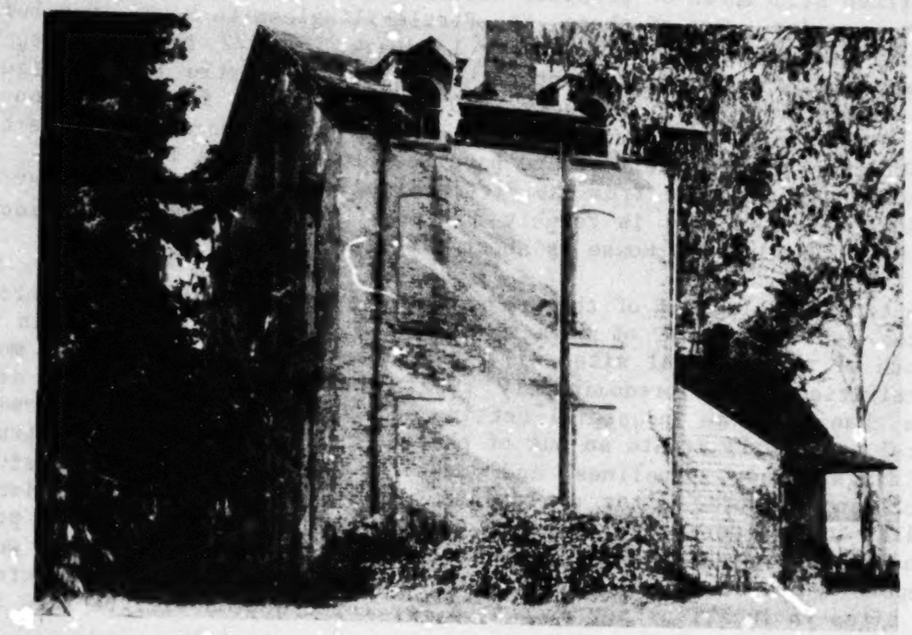
Historic Baseline. Evidence of historic sites and standing structures, dating from the early 1800s is found generally on the upper terraces and ridges of both sites. An apparent outmigration from the areas occurred in the 1950s and 1960s leaving many houses abandoned and in poor condition. Recent houses have been constructed on some of the more desirable abandoned house sites.

Twenty-four standing structures were surveyed on the Hancock site. None was determined by the Kentucky State Historic Preservation Officer (SHPO) to be eligible for nomination to the National Register. Rock shelters at Jeffry Cliff are reported to have been used as campsites for Morgan's raiders during the Civil War. There are 7 historic cemeteries on the site (Table 3.1-1).

Ten structures on the Indiana side of the Ohio River that are in view of either the Hancock or Breckinridge site were submitted to the Indiana State Historic Preservation Officer for evaluation. Three structures overlooking the Hancock site and one across from the Breckinridge site were determined to be eligible for nomination to the National Register of Historic Places. Across from the Hancock site are Lafayette Springs, which is a rock bluff with a marker commemorating the location where Lafayette spent the night after the steamer Mechanic sank in the Ohio River, May 9, 1825; the Mason House, an unoccupied two-story frame Italianate house located near Rocky Point Marina; and the Wilbur House, an occupied two-story frame Italianate structure located near the Cannelton Lock and Dam. The potential National Register candidate across from the Breckinridge site is a one and one-half story frame Carpenter Gothic house believed to have been built in the 1880s.

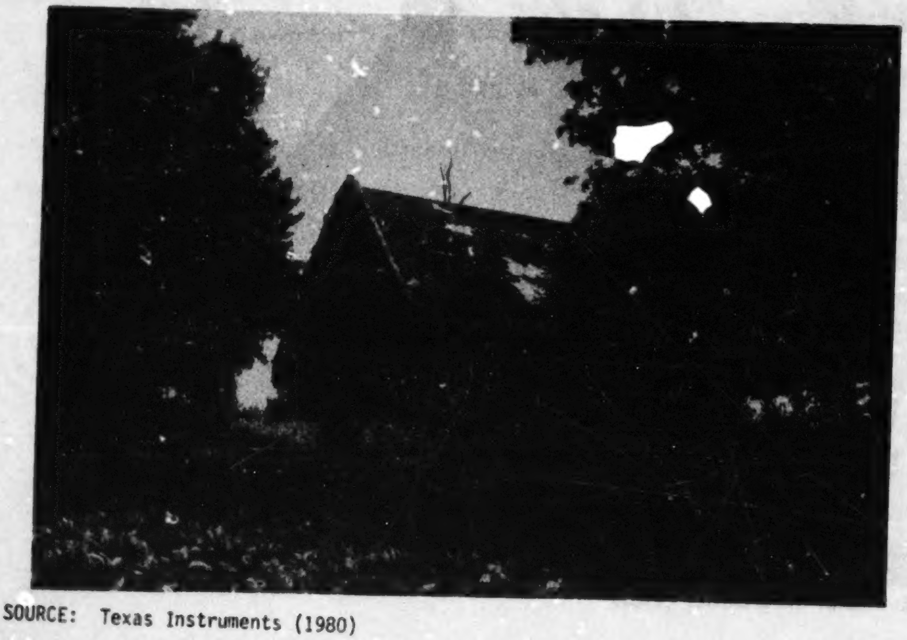
Nineteen standing structures were surveyed on the Breckinridge site, but changes in KU's boundaries eliminated 7 of them. Among the remaining structures, 6 are presently occupied houses, 4 are unoccupied or abandoned houses (one of these abandoned house locations contains a group of 10 individual houses previously used by No. 45 Lock and Dam employees), one is an abandoned church, and one is the powerhouse associated with the former No. 45 Lock and Dam. None was determined by the Kentucky SHPO to be eligible for nomination to the National Register. There are 3 historic cemeteries on the site.

Two structures on the Breckinridge site, the Joseph Holt House and the Holt Chapel (Figures 3.1-11 and 3.1-12), are on the National Register of Historic Places. The Holt House, which is presently unoccupied and in fair condition, was constructed in 1850 and expanded in the 1870s; it exhibits Italianate Villa features. The Holt Chapel, built in 1871, is a Gothic Revival structure that is now abandoned and deteriorating.



SOURCE: Texas Instruments (1980)

Figure 3.1-11. Joseph Holt House, Breckinridge Site, 1980

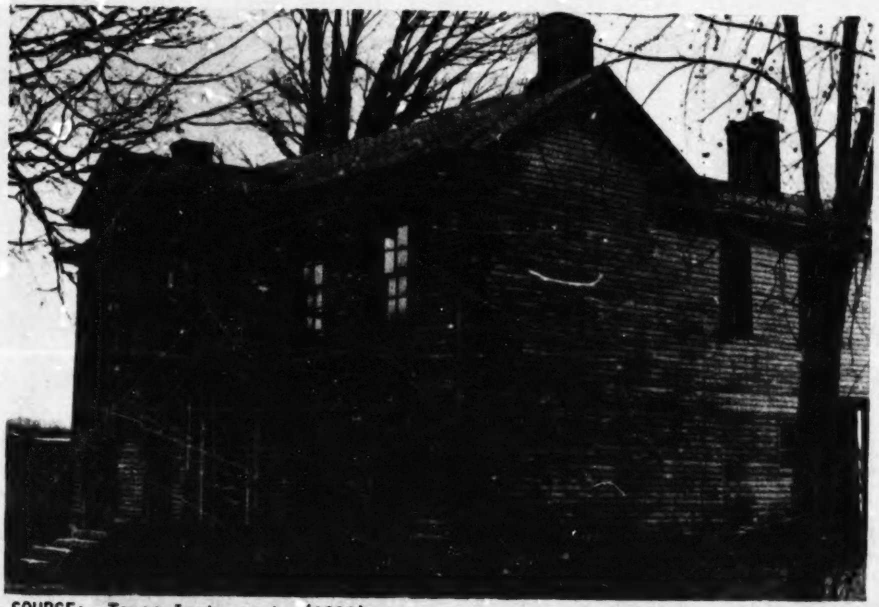


SOURCE: Texas Instruments (1980)

Figure 3.1-12. Holt Chapel, Breckinridge Site, 1980

Fifteen structures of possible historic value were surveyed along the Elizabethtown corridor. One of these, the Pirtle-Klinglesmith House, was built circa 1808 and was designated a Kentucky Landmark in 1972 by the Kentucky Heritage Commission. A second structure, the Stamper Pirtle House (Figure 3.1-13), was determined by the Kentucky SHPO to be eligible for nomination to the National Register. The Stamper Pirtle House is a two-story, five-bay Italianate structure that is believed to have been built in the late 1800s. It is located less than one mile from the Pirtle-Klinglesmith House on highway 86 in Howe Valley, Kentucky. It is roughly 300 feet from the existing corridor, while the Pirtle-Klinglesmith House is about 1100 feet away.

Impacts. Evaluation of the project area's archaeological and historical resources and assessment of impacts is based on criteria defined in 36 CFR 800. Each of the cultural sites will be indirectly affected by land modification activities. The predominately rural character of the plant site area will be changed to an industrial setting and the presence of transmission lines in rural areas will create an out of character visual element. Construction of buildings, roads, pipelines, and docks on the plant site will disturb archaeological and historic sites on lowland areas and along the Ohio River, while landfills will alter those sites in uplands. Because of extensive preconstruction evaluation and salvage of known sites and instructions to work crews to report undiscovered sites, loss of unknown sites is not expected. Any unknown sites in locations not excavated for construction will be left for future discovery.



SOURCE: Texas Instruments (1980)

Figure 3.1-13. Stamper Pirtle House, Elizabethtown Transmission Corridor, 1980

There will be no impact on National Register historic sites on the Hancock site. Seven of the potential National Register archaeological sites are in locations where facilities are proposed (see Figures 2.1-2 and 3.1-9): 15HA124 is the location of pond C; 15HA131 is in the main facilities area; 15HA138 is by the cooling tower location; 15HA144, 15HA146, and 15HA152 are within the cooling tower make-up pipeline and blowdown pipeling right-of-way; and 15HA156 is at the bridge and access road to the barge unloader. Eight of the archaeological sites are in locations to be used during landfill operations: 15HA111, 15HA114, 15HA116, 15HA117, 15HA118, 15HA180, 15HA181, and 15HA182. The remaining sites possibly would be affected by construction activities in general and/or landfill activities. Two cemeteries, Lake Cemetery and Flake Cemetery, are located in one of the landfill areas. The Younger-Brashear Cemetery is near the main facilities area.

On the Breckinridge site, the Holt Chapel is likely to be affected by general construction near the SO_2 removal equipment (see Figures 2.1-7 and 3.1-10. The Holt House is not likely to be directly affected by construction, although its location on Highway 144 makes it subject to impacts from increased traffic, noise, and fugitive dust. Four of the potential National Register archaeological sites are in locations where facilities will be constructed: 15BC90 is near the SO_2 removal equipment; 15BC93 is in the area of the inactive coal pile; 15BC99 is in the area of the coal and limestone barge unloading facilities; and 15BC19 is in the area of the inactive coal pile, limestone diverter house, stockout pile, and transfer house. The remaining site is on the Ohio River and, although near the barge facilities, is less likely to be directly affected by construction activities. The three cemeteries are located near construction areas and may not be directly disturbed. A slave cemetery is adjacent to the access road to the makeup pump house, the Burk-Stephens Cemetery is near a landfill area, and Holt Cemetery is on Highway 144, which will be the main access to the site.

The Stamper Pirtle House on the Elizabethtown corridor will be subjected to short-term increased traffic, noise, and fugitive dust during local construction of the Unit 2 transmission system. For the long-term, the addition of another transmission line (especially one that will create an adverse visual contrast with the existing line) will intensify the aesthetic impact on its viewshed.

The Indiana SHPO has determined that there will be no adverse impact from development of either site on the Indiana historic structures eligible for nomination to the National Register.

In accordance with 36 CFR 800, EPA Region IV completed nomination forms for the eligible historic structures and initiated consultation with the Keeper of the National Register of Historic Places.

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Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 1 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Population				
Population Size and Distribution	Immigration of project workers and dependents: Peak immigration (714) in 1992, including temporary (480) and permanent (234) residents.	Assumed distribution in 3-county area would mean maximum population increase in 1992 of 5.5% over 1980 Hancock County population level.	Assumed distribution in 3-county area would mean maximum increase of 2.5% in Breckinridge county population over 1980 level. Increase of as much as 25% in the portion of the county in which the site is located.	During construction period (1982-1994), KU project will temporarily increase population in the 3-county project area by as much as 1.6% over current population.
	Permanent immigrants by 1994 (324).	Approximately 4% increase in county population. Greatest concentration of new residents in county expected west of site from Hawesville to Lewisport.	Approximately 2% increase in county population. Expected location of new residents in Cloverport area.	After 1994, project will permanently increase project area population by approximately 0.7%. Influx of new population may slow outmigration from both counties and cause greater overall rate of population growth.
	Concurrent development of H-Coal project.	Maximum combined influx of 2700 construction workers and dependents in 1986 would increase 3-county project area population by 4.5% over KU increase. Potential for one-third of H-Coal operating immigrants to settle in Hancock County.	Same. Potential for at least one-third of operating immigrants to settle in Breckinridge County.	Approximately 4 times greater temporary increase in project area population from immigration of construction workers and at least 5 times greater permanent increase from operation personnel. H-coal development will overshadow population changes caused by the KU project.
Housing	Immigration of construction and operation personnel.	Maximum demand for 86 purchase units in Hancock County, 29 in Perry County, and 12 in Breckinridge County. Rental unit maximum demand of 41 in Hancock County, 41 in Perry County, and 17 in Breckinridge County.	Maximum demand for 86 purchase units in Breckinridge County, 29 in Perry County, and 12 in Hancock County. Rental unit maximum demand of 41 in Breckinridge County, 41 in Perry County, and 17 in Hancock County.	Based on 1970 housing availability, a shortfall of 16 rental units in Hancock with Hancock alternative and a few rental units there with the Breckinridge alternative. Rental demands probably can be met in other counties, but locations may be undesirable. Purchase demand apparently can

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 2 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Housing (Cont.)				be met under any alternative, but desired quality may necessitate new construction.
	Immigrant operation personnel.	Net purchase demand of 57 units in Hancock County.	Net purchase demand of 57 units in Breckinridge County.	
	Transients and visitors associated with the project.	Demand for motel, trailer, and similar units.	Same.	Strain on project area's 100 motel units likely; virtually no other similar facilities available.
	Concurrent development of H-Coal project.	Significantly increased competition for housing demand.	Same.	Will induce large-scale housing construction, but will initially raise prices of available units.
Transportation	Construction work force.	Maximum increase of 550 cars per day on U.S. 60 and Hwy 1406.	Same on U.S. 60 and Hwy 144.	Hancock alternative would increase U.S. 60 usage near Hawesville by 50% and Hwy 1406 usage by 100%; major impact due to U.S. 60 conditions. Breckinridge alternative could have less impact on U.S. 60 traffic if some commuters from Louisville use Hwy 144 from the northeast; existing traffic on Hwy 144 less than that on Hwy 1406.
	Operation work force.	Increased usage of Hwy 1406 by 60% over present.	Double existing usage of Hwy 144.	No significant impact.
	Construction and operation of the power plant.	Increased highway, barge, and rail traffic.	Same.	No significant impact on rail and barge traffic. Truck traffic may cause congestion on U.S. 60 and will increase maintenance frequency on U.S. 60 and site access roads.
	Concurrent H-Coal development.	Greatly increased usage of U.S. 60.	Greatly increased usage of U.S. 60 and Hwy 144.	Probably would induce 4-lane construction of U.S. 60 and Hwy 144.

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 3 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Transportation (Cont.)	Transmission construction.	Access road construction. Disruption of road travel.	Same.	Will increase road miles along Unit 1 corridor. Disruption of traffic will be controlled and no impact expected.
Socioeconomic Conditions				
Regional Employment and Income	Peak construction work force in 1988 (981).	Employment of 113 Hancock County workers with effective buying income (EBI) of $4.7 million.	Same.	Approximately 28% of the construction work force is expected to come from the 4-county project area, the rest coming from the other counties in the 17-county region. Peak direct salaries $63.5 million.
	Peak employment in 1992 (916 construction workers, 130 operators).	Employment of 208 Hancock County workers with (EBI) of $7.8 million. Maximum increase in Hancock County income directly from construction will be about 4.4%.	Same. Maximum increase in Breckinridge County income directly from construction will be about 2.5%.	Peak work force requirements in 1988 and 1992 will exceed the approximately 875 unemployed construction workers in the 17-county region in 1978. Required work force for all other years could be obtained within the region. Peak direct income from the project ($84 million) represents 0.3% increase in 17-county regional income.
	Operating personnel from 1994 throughout project (180)	72 local hires; 108 immigrants; all assumed to reside in Hancock County. Project EBI will represent 2.25% of county EBI.	Same. Project EBI will represent 1.2% of county EBI.	Breckinridge alternative will be of greater benefit to that county than will the Hancock alternative to Hancock County: project-related average EBI is $44,000; projected average Hancock Co. EBI without the project is the same; projected average Breckinridge Co. EBI without the project is $32,450. Industrial sector is small in Breckinridge Co. and large in Hancock Co.

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 4 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	Environmental Consequences Breckinridge Site Alternative	Duration/Significance
Business	Direct expenditures by KU, immigrants, and commuting workers.	Increased local and regional business activity. Estimated direct increase in retail business activity in project area from plant construction = $117.62 million. Indirect business activity would increase at the rate of 90%.	Same.	County business activity would increase in the project area in proportion to present distribution of goods and services. Not expected to induce change or new business buildup.
Industry	Presence of power plant.	Not expected to induce satellite industries.	Same.	Not expected to preclude other industry either, although local PSD increment consumption high.
Agriculture (see land use)				
Taxes	State income taxes.	Estimated payment range during construction of $30 thousand in 1982 to $3.6 million in 1992.	Same.	Total payment of $16.3 million from construction.
		Estimated payment during operation of $6 million.		Based on 1989 constant dollars for 35 years.
	Federal income taxes.	Estimated payment range during construction of $174,000 (1982) to $21 million (1992).	Same.	Total payment of $95.3 million from construction.
		Estimated payment during operation of $35 million.	Same.	Based on 1989 constant dollars for 35 years.
	County and local taxes.	Personal taxes. Hancock County's occupational tax will accrue an estimated $3.1 million during construction of the plant. (payments range from $5.7 thousand in 1982 to $687 thousand in 1992).	No occupational tax in Breckinridge County.	Peak represents a 41% increase over total Hancock Co. 1979 revenues. However, continued increases in county revenues (1981 occupational tax alone = $1 million) will reduce this percentage substantially by 1992.
		Facilities taxes. Estimated local taxes on KU facilities: Unit 1 (1988$) = $640,000 Unit 2 (1992$) = $167,000	Same.	Increase in total county revenues higher in Breckinridge County, and increase in local

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 5 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Taxes (Cont.)		Both units (1992$) = $1,069,000.		tax base greater in Hancock Co.
		Effect of completed facility on current tax revenues: local tax base = 75% increase local property tax revenues = 330% increase total county revenues = 21% increase.	Effect of completed facility on current tax revenues: local tax base = 47% increase local property tax revenues = 200% increase total county revenues = 54% increase.	Although the increase in property tax revenues is lower in Breckinridge Co., the relative increase from the KU project is more significant in Breckinridge Co. since it relies more heavily on property taxes for total revenue.
	State taxes.	Estimated state taxes on KU facilities: Unit 1 (1988$) = $1,483,000 Unit 2 (1992$) = $ 940,000 Both units (1992$) = $3,033,000 Completion of facility expected to increase the county's state tax base by 150%.	Same. Completion of facility expected to increase the county's state tax base by 200%.	
Social Services	Construction and operation of generating station.	Reduced need for social services due to reduced unemployment. Increased tax revenues from the project will increase funds available for allocation by the Commonwealth. Potential for improved social services.	Same.	Beneficial impact on the project area by reducing demand and improving the quality of social services.
	Concurrent development of H-coal project.	Intensified competition for housing and increased prices for goods and services. Stress from crowding, congestion, and changes in community composition.	Similar impact. Especially a problem in Breckinridge County where the population is aging, incomes are relatively low, and lifestyles are established.	Potentially adverse impact. Increased need for housing assistance, food stamps, medicare, and general welfare support for people unable to benefit from the KU and H-coal projects.

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 6 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Health Care	Construction and operation of generating station.	Increased potential for accidents, especially during construction.	Same.	Impact compounded by lack of hospitals and medical personnel in the vicinity of the sites.
		Increased traffic on area highways - more traffic accidents and slowed access to hospitals.	Same.	
	Concurrent development of H-coal and other projects in the region.	Increased demand for medical services due to additional population and reduced access to health care centers due to traffic congestion.	Same.	As in the case of housing and road construction expected to be induced by cumulative projects, there will be major short-term impacts until supply and demand are balanced.
		Potential to attract doctors to the area due to increased population and to construct private or public health care facilities with increased tax revenues.	Same.	
Municipal Services	Immigration of workers and dependents.	Marginally adequate number of police in the project area counties may be seriously stressed. Traffic congestion and accidents could adversely impact both county sheriffs and community police.	Same.	Potentially serious impact, especially during construction with a peak work force of up to 1000 people stressing services. Additional full-time or part-time officers will be needed.
	Increased housing construction in communities; land clearing onsite and along corridors.	New housing units are not expected to significantly increase risk of fire due to small numbers.	Same.	Fire fighting services are expected to be adequate in project area due to minimal increase in risk of fire.
		Potential for fires onsite and along corridors from slash burning activities.	Same.	
	Generating station construction.	Sewage and water facilities will be built onsite to accommodate all construction and operation requirements.	Same.	Municipal sewer and water supplies will not be adversely impacted by construction of the project.
		Use of county sanitary landfill.	Same.	Would stress existing sanitary landfill but counties are required by Commonwealth law to

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 7 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	 Breckinridge Site Alternative	Duration/Significance
Municipal Services (Cont.)				supply sufficient areas.
	Additional housing construction.	Construction of the 70-80 additional housing units needed will not affect sewage treatment systems or water supplies in the county.	Same.	No adverse impacts to sewer systems or water supplies are expected due to KU project.
	Concurrent development of H-Coal project.	Construction of possibly 300-400 housing units could impact sewage treatment systems and water facilities.	Same.	Addition of H-coal project would substantially increase demand and probably result in a shortfall in water and sewer system service in Hawesville and Cloverport.
Education	Construction and operation of generating station.	At peak construction, school enrollment will increase about 4% over that of the late 1970s in Hancock Co.	At peak construction, school enrollment will increase about 2% over that of the late 1970s in Breckinridge Co.	Fluctuations in enrollment and disruptions from new students coming in at odd times are expected to be more of a problem than changes in average numbers of students.
		Estimated 6% increase in enrollment during operation phase of project.	Estimated 3% increase during operation.	Although impact appears greater in Hancock Co., previous experience with other major construction projects in recent years will reduce problems.
		Expected student/teacher ratio during construction = 24/1. Expected ratio during operation = 25/1.	Expected student/teacher ratio during construction 18/1. Expected ratio during operation - 20/1.	No undue stress expected in Hancock County. Possible concentration of impacts on Breckinridge Co. in Cloverport increases the potential for adverse impacts. However, due to low student/teacher ratio and declining enrollment, Cloverport schools have the capacity for absorbing additional students.
Social and Community Structure	Immigration of construction personnel.	Present resistance to the project in Hancock Co. may hinder acceptance of immigrant workers until project is generally tolerated.	Limited resistance to the project in Breckinridge Co. should facilitate acceptance of immigrant workers and speed their assimilation into the	Impact on Hancock County will depend on magnitude of resistance, but even a small level of resistance would make integration difficult. Effects

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 8 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Social and Community Structure (Cont.)			community.	on community institutions may be more dependent on internal discord over the project than on new members or participants. Expected short-term impact.
		Level of assimilation into community structure or life also influenced by workers' desires to participate in the community.	Again, level of assimilation depends on workers' desires to participate.	
	Immigration of operation personnel.	Most resistance expected to dissipate by operation phase. Some changes in social order since most new residents would be in upper income brackets. Expected integration of workers and their families into social and community organizations.	Similar impacts in Breckinridge Co. communities. Cloverport, especially, would benefit by infusion of even a small number of new, relatively affluent residents. KU project has been generally overshadowed in Breckinridge Co. by prospects of the much larger H-Coal project.	Assimilation of newcomers into communities will probably intensify and continue existing social order. Net effect of the influx of new people will probably be beneficial to the communities and their institutions.
Land Use				
Agricultural land (see VEGETATION)	Site clearing, grading, facilities construction.	Elimination of approximately 4% of Hancock County's current corn, soybean, and tobacco production. Projected annual crop value loss = $241,500. Approximate onsite cropland loss = 750 acres (32% of land use).	Elimination of approximately 3% of Breckinridge County's current soybean production and less than 1% of the corn and tobacco production. Projected annual crop value loss = $231,200. Approximate onsite cropland loss = 1008 acres (41% of land use).	Essentially irreversible preemption of farmland for industrial use. The percent reduction in agricultural production is greater on the Hancock site, although agriculture is a smaller percent of Hancock County's economic activity. (Agricultural sales in 1972 were 6.4% of economic activity in Hancock County and 33.4% in Breckinridge County).
		Approximate onsite pasture land loss = 759 acres (32% of land use).	Approximate onsite pasture land loss = 422 acres (17%) of land use).	Loss of pasture land during life of project.

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Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 9 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	 Breckinridge Site Alternative	Duration/Significance
Agricultural Land (See VEGETATION) (Cont.)				Currently a minor portion of agricultural economy of both sites due to limited livestock production.
	Clearing, grading, road and tower construction on Unit 1 and Unit 2 corridors.	Estimated agricultural land affected: Unit 1 = 45 acres (22% of land use). Unit 2 = 416 acres (76% of land use). Direct usage loss is less than 1 acre for both corridors.	Estimated agricultural land affected: Unit 1 = 126 acres (40% of land use). Unit 2 = 384 acres (80% of land use). Direct usage loss is less than 1 acre for both corridors.	Some productivity (but not economic) loss is expected on cropland during construction. Agricultural productivity losses will be temporary except at tower locations where usage loss will esentially be permanent.
Woodlands (See VEGETATION)	Clearing, grading, and solid waste disposal onsite; and clearing and herbicide spraying on corridors.	Approximate woodland loss onsite = 655 acres (28% of land use). Approximate woodland loss on corridors: Unit 1 =159 acres (78% of land use). Unit 2 = 134 acres (24% of land use).	Approximate woodland loss onsite = 959 acres (38% of land use). Approximate woodland loss on corridors: Unit 1 = 188 acres (60% of land use). Unit 2 = 99 acres (20% of land use).	Long-term preemption of most woodland land use for industrial and linear land uses. Permanent loss of some woodlands due to extent of habitat disruption. Elimination of future timber maturation and production on cleared lands.
Streams and Water Bodies (see WATER)	Site clearing, grading drainage alteration.	Disruption of 3 streams and elimination of stock ponds. Alteration of approximately 11 acres of water land use.	Disruption of 1 stream and elimination of stock ponds. Alteration of approximately 23 acres of water land use.	No significant land use impact on offsite streams and water bodies. Maximum disturbance of 1% of onsite land use.
Recreation Areas	Immigration of construction workers, operation personnel, and their dependents.	Increased use of surrounding recreational facilities, especially Hoosier National Forest and Rough River Dam State Resort Park.	Same.	Moderate impacts on recreation areas during 1987-1988 and 1991-1993 due to peak construction worker influx.
	Construction of industrial facilities.	Decreased use of site for hiking and nature study.	No change due to negligible use of site for hiking and nature study.	Permanent adverse impact on Jeffry Cliff as recreation area due to surrounding industrial development and limited access.

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 10 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Recreation Areas (Cont.)	Construction of outfall structure on Ohio River.	Greater number of game fish may be attracted to area and available for fishing.	Same.	Value for fishing depends on whether KU will allow fishing close to facilities.
	General construction activities.	No change due to negligible use of onsite streams for fishing.	Decreased fishing in Town Creek Embayment.	Temporary reduction in fishing due to increased congestion and activity during construction phase.
	Vegetation clearing and general construction activities onsite.	Loss of wildlife habitat.	Same.	Essentially permanent reduction of hunting potential due to loss of habitat.
	Vegetation clearing and maintenance along corridors.	Creation of open habitat for game and increased hunter access.	Same.	Hunting potential is expanded, but increased game harvest may reduce quantity and quality of hunting opportunites over time.
Mineral Resources	Corridor construction.	Potential interference with coal, oil, and gas extraction.	No anticipated impact on coal resources. Minimal potential interference with gas and oil extraction.	Effect on mineral resources dependent on routing or Unit 1 corridor, but more likely on Hancock alternative due to location and extent of resources.
Cultural Factors				
Visual Resources	Onsite vegetation clearing, grading, construction of structures and facilities, and filling of ravines with solid waste.	Elimination of contrasting landforms and vegetation patterns.	Similar impact, but fewer visual contrasts lessen existing aesthetic quality.	Permanent degradation of existing aesthetic quality, more significant on Hancock site.
		Detraction of visual unity and incompatibility with predominant rural agrarian character.	Same.	Although other industry is existing near the Hancock site and proposed near the Breckinridge site, the sites and the region still retain a rural agrarian character. Further industrial development will permanently alter the character of the sites and be an

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 11 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Visual Resources (Cont.)				incremental step toward alteration of the region.
		Alteration of landscape is more visible and viewed by a greater number of people.	Alteration of landscape is less visible and viewed by fewer people.	The Hancock site is more sensitive to reductions in aesthetic quality due to its larger viewshed and greater viewer population.
		High visual impact of landfill activities and lower impact of facilities due to nearby presence of Jeffry Cliff and extent of rolling topography.	Low visual impact of landfill activities and higher visual impact of structures due to increased distance to uplands and greater extent of level topography.	Visual contrast in size and scale of structures is lower on the Hancock site. Visibility and contrast of landfill activities is lower on the Breckinridge site.
		Reduction of the natural character and focal attraction of a unique landform (Jeffry Cliff).	Limited upland visibility and extent of level terrain do not produce a focal landform.	Jeffry Cliff is the most unique landform on either site. Adjacent industrial development would produce an incompatible contrast and reduce the quality of Jeffry Cliff as a vivid and harmonious focal attraction.
	Emission of plumes from cooling towers.	Greatest distant visual impact.	Same.	Extent of visibility dependent on weather conditions. Plume may blend with natural cloud formations at times or be distinct at others.
	Clearing of woodlands on corridors.	Increased visibility of corridors due to marked contrast between the low vegetation of the corridors and the surrounding forest. Greater likelihood of negative visual impact due to more extensive woodlands, particularly along Unit 1.	Similar impact on wooded areas but greater extent of agricultural land along Unit 1 corridor increases potential for avoiding woodlands and reducing the negative visual impact.	Greatest negative visual impact will be along the Unit 1 corridor since the Unit 2 corridor is existing and predominantly agricultural. Potential for greater impact on Hancock corridor.
	Clearing and construction of Unit 1	Hillier terrain, more extensive woodlands, and fewer	More open, agricultural landscape and greater road access	Potential for greater visibility of impacts on the

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 12 of 13)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	Environmental Consequences Breckinridge Site Alternative	Duration/Significance
Visual Resources (Cont.)	corridor.	access roads restrict the visibility and the number of people exposed to the visual impact.	increase the visibility and the number of people exposed to the visual impact.	Breckinridge corridor, although the impacts themselves will be less severe than on the Hancock corridor.
	Erection of steel transmission towers on Unit 2 corridor.	Visual incompatibility with existing wooden towers.	Same.	Adverse visual impact due to contrast of two different types of towers along the Elizabethtown corridor.
Archaeological Resources	Site clearing; grading; construction of buildings, roads, pipelines, and docks; and waste disposal in landfills.	Removal of known and potential destruction of undiscovered archaeological sites; isolation from the surrounding environment; introduction of out-of-character visual, audible, or atmospheric elements.	Same.	Permanent loss of a nonrenewable resource either through changes in the integrity of the setting of the property (most sites) or potential destruction of undiscovered sites (few, if any).
		Of the 95 archaeological sites surveyed, Kentucky Heritage Commission has recommended testing 33 sites (5 of which may be outside site boundaries) to determine eligibility for National Register of Historic Places.	Of the 68 archaeological sites surveyed, Kentucky Heritage Commission has recommended testing 5 sites (located within present boundaries) for eligibility for National Register. (Survey of this site is incomplete and covered approximately 65% of site).	At this time, impact appears greater on Hancock site due to more numerous archaeological sites on floodplains, lower terraces, and rockshelters near Jeffry Cliff. Locations remaining to be surveyed on the Breckinridge site are not expected to have significant archaeological sites.
Historic Resources	General construction and landfill activities. Also, increased traffic, noise, and fugitive dust.	Similar disturbance as for archaeological sites.	Same.	Permanent loss of a nonrenewable resources either through direct destruction of specific sites or changes in the integrity of the setting.
		Distruction of structures and historic sites representative of architectural styles and heritage of late 19th and early 20th century Kentucky.	Same.	

Table 3.1-1. The Human Environment and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 13 of 13)

Affected Environment	Source of impact or Effect	Environmental Consequences Hancock Site Alternative	Breckinridge Site Alternative	Duration/Significance
Historic Resources (Cont.)		None of the 24 historic sites and structures surveyed are eligible for the National Register. Of the 7 historic cemeteries onsite, 3 will be directly affected by construction activities.	Two structures, the Holt House and the Holt Chapel, are listed on the National Register. All of the 3 historic cemeteries onsite will be affected by construction activities.	The Holt structures are protected by the National Historic Preservation Act of 1966. They are abandoned and in poor and deteriorated condition, respectively.
	Construction of Unit 2 transmission system.	One historic structure has been determined eligible for nomination to the National Register.	Same.	Regardless of which site is developed, the Unit 2 transmission system will intensify the aesthetic impact on this structure. Short-term noise, dust, and traffic impacts.

3.2 ATMOSPHERE

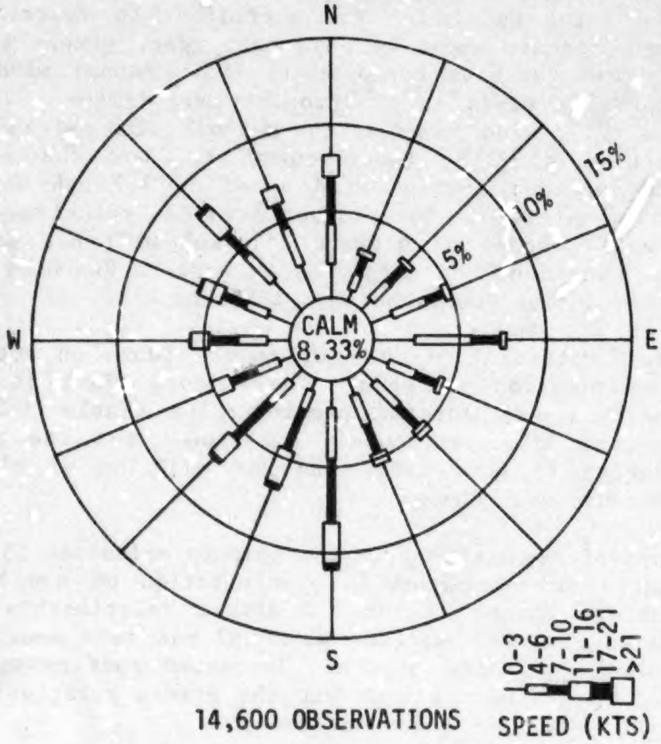
3.2.1 Climate and Meteorology

Baseline. Historical meteorology of the project area is characterized by evenly distributed annual precipitation except for noticeably smaller amounts in late summer and winter. Annual total precipitation is 45 inches, with snowfall of an inch or greater about 4 days per year. Annual mean temperature is 56°F. The mean annual heating-degree-day total is 4400 and the mean annual cooling-degree-day total is 1100. Fog sufficient to restrict visibility to less than 0.25 mile occurs about 14 days each year, generally shortly before sunrise. Annual mean relative humidity is 70%. Annual wind rose data show predominately southerly winds in the project area (Figure 3.2-1). From July 1979 through June 1980, wind speed at the Hancock site averaged 5.1 mph with a predominant direction of 215° (southwesterly). For the same period, the Breckinridge site recorded average wind speed of 3.9 mph with a predominant direction of 085° (easterly). The project area has relatively good dispersion characteristics and episodes of slowest dilution will not present dispersion related problems. Incidence of tornadoes in western Kentucky is moderate, and 2 were reported in Hancock County between 1950 and 1977.

Impacts. Potential effects of power plants on meteorology include alteration of precipitation patterns. The Hancock plant is not expected to significantly increase or decrease precipitation (Table 3.2-2) because the quantity of heat and fine particulate emissions from the chimneys will be insufficient relative to the energy and the addition of cloud condensation nuclei needed to cause such change.

Presence of SO_2 and NO_x in the chimney emissions is expected to make a small contribution to decreases in precipitation pH now being experienced over much of eastern United States. A direct relationship between reduced precipitation pH and reduced surface water pH has been documented in eastern Canada and northeastern United States. Increased surface water acidity also has been reported in southern states but the direct relationship to increased precipitation acidity has not been confirmed.

The plant's wet mechanical draft cooling towers are expected to significantly increase ground level fogging and icing. Plume downwash from this type of cooling tower occurs somewhat less than 50% of the time in the mid-eastern United States. Conditions for natural fog, which also are those associated with plume-induced fogging, occur frequently, so that plume-induced fogging may be expected often; however, it will be severe only occasionally, as is natural fog. Icing rather than fogging may occur in subfreezing temperatures. The proposed position of the cooling towers on the Breckinridge site, average wind speed, and predominant wind direction indicate that plume-induced fogging and icing will be mostly limited to onsite locations. These same considerations on the Hancock site indicate that plume-induced fogging and icing will occur on highway 1406 (Skillman Road) and the adjacent Louisville and Nashville Railway switchyard, which are within 400 and 900 feet north of the Unit 2 cooling tower. Plume-induced fogging on the Ohio River would be minor at either site and plume-induced icing at the river is not expected.



SOURCE: National Climatic Center (1975)

Figure 3.2-1. Annual Wind Rose Data, Evansville, Indiana, Station No. 93817, 1970-1974

Drift droplets containing calcium, magnesium, sodium, sulfates, carbonates, and chlorides predominantly will be emitted from the cooling towers at the rate of about 2 grams per second at maximum load and considerably less during normal load. Conservative estimates of average deposition of total drift solids from the plant are 9000 kilograms per square kilometer-month (25 tons per square mile-month) within 50 meters (150 feet) and 400 kilograms per square kilometer-month (1 ton per square mile-month) within 100 to 500 meters (300 to 1500 feet). The deposition rate estimated to occur within 150 feet is greater than Kentucky's settleable particle standard (3-month average of 15 tons per square-mile month). In closest offsite locations on either site, however, average deposition is predicted to be well below that amount.

3.2.2 Air Quality

Baseline. The project area and vicinity is in a Class II air quality region. Particulate levels during 1978-1979 appeared highest at a monitoring site 12.5 miles NW of the Hancock site, where primary (health effect) 24-hr TSP standards (260 $\mu g/m^3$, U.S., KY) were violated. Six locations exceeded secondary (welfare effect) 24-hr TSP standards (150 $\mu g/m^3$, U.S., KY) - 5 near Owensboro and 1 in Ohio County SW of the sites. Two locations near Owensboro exceeded the primary annual mean TSP standard (75 $\mu g/m^3$, U.S., KY), and one location there as well as another 3.5 miles west of the Hancock site exceeded the secondary annual mean TSP standard (60 $\mu g/m^3$, U.S., KY). Sulfur dioxide standards were not violated (2 exceedences per year) during that time, although 3 locations, all in Ohio County, exceeded the maximum allowable secondary 3-hr standard (1300 $\mu g/m^3$, U.S., KY) on one occasion. Primary and secondary NO_x standards (both 100 $\mu g/m^3$, U.S., KY) were not violated either.

Ambient air quality background levels (av. for SO_2& TSP) assigned by EPA to Kentucky Utilities for estimating PSD increments, as well as maximum values recorded during KU's 1979-1980 onsite air quality study are listed below. Values are in micrograms per cubic meter ($\mu g/m^3$).

	Air Quality Analyses	Hancock Site Monitor 1/Monitor 2	Breckinridge Site
3-hr SO_2	18	632/471	278
24-hr SO_2	6	198/153	159
Annual mean SO_2	26	27/25	19
24-hr TSP	56	103/80	73
Annual mean TSP	43	39/38	31

Presence of industry near the Hancock site appears to affect 3-hr SO_2 values more so than others. TSP values on both sites reflect fugitive dust from agricultural activities.

Impacts. The emissions control equipment proposed for the Hancock plant is expected to meet air quality standards at both sites (Table 3.2-1). Interactions of the Hancock plant and other proposed and existing major point sources of atmospheric pollutants are described in Table 3.2-2. The plant will consume a major portion of PSD increments in localized areas on and adjacent to the sites, but the Class II PSD increment standards will not be exceeded

Table 3.2-1. Maximum PSD Increment Consumption and Air Emissions on the Hancock and Breckinridge Sites and Comparison To NAAQS, PSD and NSPS

			PSD			
	Time Period	Allowable PSD Increment Consumption ($\mu g/m^3$)	Increment Consumed ($\mu g/m^3$)		% of Allowable	
			Hancock Site	Breckinridge Site	Hancock Site	Breckinridge Site
Sulfur dioxide	3 hr	512	214	242	42	47
	24 hr	91	32	39	35	43
	Annual	20	2	2	10	10
Particulates (chimney)	24 hr	37	2	2	5	5
	Annual	19	<1	0.1	0.5	0.5
Particulates (chimney and fugitive)	24 hr	37	32	-	86	-
	Annual	19	2	-	5	-

	NSPS				
	New Source Performance Standard	Maximum Project Emissions (lb/hr)		Maximum Project Emission Rate (lb/10^6 Btu)	
		Hancock Site	Breckinridge Site	Hancock Site	Breckinridge Site
Sulfur dioxide	90% removal for controlled emissions; between 0.6 and 1.2 lb/10^6 Btu	3,637	4,400	0.54	0.66
Particulates	0.03 lb/10^6 Btu	172	172	0.03	0.03
Opacity	20%	<20%	<20%	-	-
Nitrogen dioxide	0.6 lb/10^6 Btu	3,990	3,990	0.6	0.6

	NAAQS			
	Time Period	Allowable NAAQS ($\mu g/m^3$)	Consumption at Point of Maximum Interaction of All Sources ($\mu g/m^3$)	
			Hancock Site	Breckinridge Site
Sulfur dioxide	3 hr	1300	694	372
	24 hr	365	51	57
	Annual	80	41	2

Source: Kentucky Utilities Company (1981).

by the plant or due to the plant's interaction with other major point sources. There will be no impact on the nearest Class I air quality area (Mammoth Cave, Kentucky) nor on the nearest non-attainment area (Owensboro, Kentucky).

Chimney and fugitive emissions from the power plant, although not exceeding regulatory standards, will degrade ambient air quality at either site. At the Hancock site, this degradation could produce economic as well as environmental effects. The effects of entry of coal particles into Willamette's bleached pulp product system depend upon particle size, as indicated by Willamette's description of their cleaning system specifications:

> Under control conditions, with feed consistency of 0.5% and temperature of 120 - 140°F, the cleaners are capable of 80% removal of wood shives, which have a specific gravity of 0.7 to 0.8 grams per cc. Under these control conditions in the laboratory the cleaners are 80 to 90% efficient at removing particles with a size greater than 0.025 mm. If in actual operation, the inlet consistency to the cleaners increases to 1%, the efficiencies drop to 40-45%. Due to operating conditions, we are forced to run the feed consistency to our cleaners at 0.95 to 1.0%, which lowers their efficiency.
>
> Pulp fiber has a specific gravity of 1.27 to 1.40 compared with 1.20 to 1.50 for bituminous coal, which makes it very difficult for the central cleaners to differentiate between coal and pulp fiber.

Based on these specifications, Willamette has assumed an 85% removal efficiency for coal dust settling on the wood chip pile. Willamette also has stated that economic loss from coal dust contamination could approach $187,000 (1981 dollars for each day of off-grade bleached pulp production).

To estimate impact of KU's operation on bleached pulp production, computer modeling was used to derive days of bleached pulp degradation from #1 to #2 prime and days of off-grade production. For pulp production, wood chips are removed in a bottom-to-top, pie-shaped section from one of two piles that together contain approximately 100,000 tons at capacity and are cycled approximately every 50 days. Thus, on any given day, wood chips entering the pulp process would contain coal dust that was deposited during the preceding 50 days.

Computer model runs based on two different methodologies (see Section 2.5) gave annual total coal dust depositon on the chip pile of 3,757 and 67,659 grams, respectively. Assuming that local meteorology used in the latter study probably is more reflective of potential conditions, results of that study are reported. These include an average daily deposition of 185.4 grams and a maximum 50-day running average deposition of 485 grams.

The impact of the coal dust would be determined by its effect on the bleached pulp mat, which is the product Willamette sells and will use later in the new fine paper plant. Willamette's test procedures count visible dirt on samples of mat at regular intervals. The amount of dirt is estimated by comparing observed particles with a size standard and summing the total area of all visible dirt. The test involves wetting the mat so that subsurface particles are counted. A total visible dirt area of 0 to 3 mm^2 per m^2 is within #1 prime standards. Number two prime has 3.1 to 6 mm^2 per m^2 dirt area, and greater than $6mm^2/m^2$ is off grade. This test does not evaluate the effect of subvisible particles, which, if present in sufficient numbers, may cause a gray tint that makes the mat unsuitable for fine white paper. Brightness degradation in the past has been associated with fire in the wood chip pile.

Coal dust and dirt count may be related by assuming that the average visible particle is 0.02 mm^2 in cross section (from Willamette's standard particle size chart) and 1% of emitted coal particles are in the visible range (from EPA's "Survey of Fugitive Dust from Coal Mines"). The area of pulp mat obscured by one gram of coal dust would be 6,963 mm^2. When considered relative to daily pulp production (2000 ft^2 per minute = 267,561 m^2 per day), this results in a visible dirt count (DC) of 0.026 mm^2 per m^2 on that day. To derive DC from coal dust (CD) that falls in the chip pile, 0.026 is reduced (R) by the percent of coal particles the cleaning process fails to remove (15%) and the percent visible emissions (1%) (R = 0.01 x 0.15). Average background dirt count (ADC) is considered, so that:

$$DC = (0.026 \times R \times CD) + ADC$$

Based on ADC of 1.94, the CD deposition required to achieve a DC of 3.1 is 29,744 grams. Since the maximum 50-day running average deposition predicted by the model was 485.5 grams, the model demonstrates no impact from the coal storage with respect to visible dirt count.

This equation does not account for possible brightness degradation from subvisible particles and, as mentioned, there is no quantitative standard for calculating loss of brightness. Based on emitted coal dust having a median particle size of 20 microns (from EPA document referenced above) and considering the cross-sectional area of a 20-micron particle ($3.1416 \times 10^{-10} m^2$), there will be 55.6 mm^2 of surface obscured by each gram of coal dust. A subvisible soil ratio (SSR) can be defined as the area occupied by subvisible particles relative to surface area of the pulp mat. The SSR is computed similar to dirt count, using a reducing factor (RSV) of 0.15 x 0.99. For each gram of subvisible coal dust in the pulp mat, the SSR is 0.000208 mm^2/m^2. SSR is derived from coal dust that falls in the chip pile by:

$$SSR = 0.000208 \times RSV \times CD$$

Unlike dirt count, SSR cannot be compared with a standard to determine days of off grade due to brightness loss.

The model used to compute coal deposition (Industrial Source Complex) is considered accurate to within a factor of two if emissions are steady state, terrain is flat to gently rolling, and several years of local meteorological data are available. In this case, an order of magnitude of uncertainty was considered appropriate for estimating impact based on lack of specific knowledge of numerous factors among these three conditions. Because of the unknown possibility of contamination from subvisible particles with 50% fugitive emissions control now proposed by KU, alternative methods of dust control or protection of the wood chip pile were suggested in Section 2.5.

The primary impact to air quality from the Hancock transmission system will be localized increased particulate levels during construction. Maximum fugitive dust emissions during Unit 1 transmission corridor construction are estimated to be 37 $\mu g/m^3$, which will have a slight to moderate impact on ambient concentrations. Similar emissions during widening of the Elizabethtown corridor are expected to be 15 $\mu g/m^3$, which will have a slight impact on ambient concentrations.

3.2.3 Noise

Baseline/Impacts. Ambient noise levels at the 2 sites have not been measured. Higher background noise levels around the Hancock site are evident on Highway 1406 near Willamette Industries and the Louisville and Nashville Railroad switchyard. Noise levels at the Breckinridge site, like those elsewhere at the Hancock site, are attributable to agricultural activities primarily.

Estimated noise levels on each site and the impacts of noise attributable to the power plant are described in Table 3.2-2. During plant construction, ambient noise levels will be affected by equipment operation and increased traffic. Highway traffic will lighten somewhat after construction, although truck traffic will remain substantially greater than presently, as will barge traffic. Facility components that are expected to be the major sources of environmental noise during operation are forced- and induced-draft fans, safety valves, coal handling equipment, cooling towers, PA systems, boiler or reactor feed pumps, and station transformers. The 345-kV transmission system could have slight noise effects of a buzzing nature directly under the lines, especially during bad weather.

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Table 3.2-2. The Atmosphere and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 1 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Climate and Meteorology	Onsite construction activities.	Potential for increased cloudiness due to increased cloud condensation nuclei from airborne particulate matter.	Same.	Negligible possibility of significant cloudiness or change in precipitation.
	Land clearing during construction.	Potential for increasing surface temperatures during the daytime and lowering temperatures at night due to increased reflection of solar radiation as vegetation is removed. Resulting convection patterns may alter surface wind patterns.	Same.	Wind change patterns are expected to be slight and impacts negligible. Soil flora and fauna will be diminished. Effects are reduced as areas are revegetated.
	Emissions and heat released from boiler chimneys during operation.	No anticipated effect on precipitation from heat release. Minor increases or decreases in precipitation due to formation of cloud condensation nuclei or ice nuclei from fine particulate matter emissions. Potential for decrease in pH of regional precipitation due to airborne releases of sulfur dioxide and nitrogen oxides.	Same.	No significant effects on precipitation from heat or fine particulate matter emissions from boiler chimneys. Small contribution to overall changes in precipitation pH, with most impact outside the project area; however, project area is being affected similarly by emissions from other sources. Impacts will continue throughout station operation.
	Cooling tower plumes.	Plume-induced fogging and icing will occur offsite on Skillman Road and the adjacent L & N Railway switchyard north of the cooling towers.	Little probability of offsite plume-induced fogging and icing, particularly along highway 144.	Plume-induced fogging will be frequent. Potentially hazardous reduction in visibility for travelers and train operators near the Hancock site during occasional periods of severe plume-induced fogging and icing. Plume-induced fogging on the Ohio River at either site will be minor and no icing is expected.
		Higher potential for fogging and icing due to higher wind speeds.	Lower potential for fogging and icing due to lower wind speeds.	

Table 3.2-2. The Atmosphere and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 2 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Climate and Meteorology (Cont.)				Impacts are expected to continue throughout station operation.
	Emission of drift solids from cooling towers.	Expected short-term (maximum generating capacity) deposition of 130 mg of drift solids per 9 square feet-hour within 150 feet of the towers and long-term rate of 25 tons per square mile-month within 150 feet.	Same.	Onsite deposition rate within 150 feet exceeds Kentucky's settleable particulate standard, but closest offsite rates are much lower. Potential for vegetation and soils impact onsite, but no significant impact anticipated offsite.
Air Quality	Construction activities (grading, clearing, facilities construction, wood burning, vehicular traffic).	Increased fugitive particulate emissions.	Same.	Extent of impact dependent on nature and degree of activity and weather conditions. Could increase TSP levels significantly. Continual throughout 12-year construction period but greatest during Unit 1 construction.
	Sulfur dioxide, particulates, and nitrogen dioxide emissions from boiler chimneys.	Increased concentrations of these pollutants in the atmosphere.	Same.	Significant local increment consumption for life of the station; however, emissions will meet applicable EPA standards of performance for new major stationary sources. Lower SO_2-removal efficiency on the Breckinridge site will contribute to greater increment consumption.
		Maximum 3-hour SO_2 increment consumption is 42%, occurring in a localized area near southern border of site, west of Jeffry Cliff; 20% consumption will occur on portions of the Ohio River, Hoosier National Forest and Jeffry Cliff.	Maximum 3-hour SO_2 increment consumption 47% in a localized area in the eastern portion of the site; 25 to 35% consumption will occur in several adjacent locations, including the Ohio River.	
		Maximum 24-hour SO_2 increment consumption will be 35%, in a localized area on the Ohio River west of the site; 20% consumption will occur in relatively extensive adjacent locations (up to two miles) in virtually all directions from the site.	Maximum 24-hour SO_2 increment consumption will be 43%, in a localized area of the Ohio River west of the site; 20% consumption will occur up to two miles from the site in virtually all directions.	

Table 3.2-2. The Atmosphere and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 3 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Air Quality (Cont.)		Consumption of each increment in outlying locations is 5 to 10%.	Same.	
	Interaction with other proposed point sources.	Greatest impact with proposed Rockport Generating Station: Maximum 3-hour average SO_2 concentration (180 $\mu g/m^3$) will occur 0.9 miles east of Hancock site. Maximum 24-hour average SO^2 concentration (27 $\mu g/m^3$) will occur 1.8 miles east of the Hancock site.	Greatest impact with proposed Rockport Generating Station: Maximum 3-hour average SO_2 concentration (157 $\mu g/m^3$) will occur 0.7 miles west of the Breckinridge site. Maximum 24-hour average SO^2 concentration (45 $\mu g/m^3$) will occur 1.0 mile west of the site.	Isopleths of 3-hour and 24-hour SO_2 increment consumptions from the Breckinridge site will encompass relatively large adjacent and surrounding off-site areas.
	Interaction with existing and new point sources.	Maximum combined 3-hour average SO_2 (694 $\mu g/m_3$) will occur at a point 0.6 miles southeast of the Hancock site. Maximum combined 24-hour average SO_2 (51 $\mu g/m^3$) will occur at a point 0.6 miles ESE of the Hancock site. Primary interactor is Coleman Generating Station.	Maximum combined 3-hour average SO_2 concentration (372 $\mu g/m^3$) will occur 0.9 miles SE of the site. Maximum combined 24-hour average SO_2 concentration (57 $\mu g/m^3$) will occur at the same point. Primary interactor is Coleman Generating Station.	Interactions with existing and proposed major point sources at both sites will not cause violations of air quality standards.
		Greatest long-term predicted impact on regional air quality is maximum annual SO_2 concentration of 41 $\mu g/m^3$ at a point 8 miles NW of the site.	Greatest long-term predicted impacts on regional air quality are maximum annual SO_2, TSP, and NO_2 concentrations of 2, 0.8, and 2 $\mu g/m^3$, respectively, about 2.4 miles NE of the site.	Air quality standards are not exceeded.

Table 3.2-2. The Atmosphere and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 4 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Air Quality (Cont.)	Fugitive dust emissions from coal and limestone handling systems.	Ambient particulate levels increased from coal and limestone barge unloading, transfer, and storage. Based on 50% control for the open coal pile and much higher efficiencies for other controls, maximum emissions will be 425 pounds per day and annual average will be 36 tons per year.	Same. No modeling was done since coal dust emissions are not a public issue on this site.	Air quality standards not exceeded, but since attributable to coal dust, could have adverse effect on the bleached pulp and paper processed at the Willamette facility adjacent to the Hancock site.
	Fugitive dust emissions from transmission system construction on corridors.	Maximum 24-hour particulate concentration from construction of Unit 1 corridor = 37 $\mu g/m^3$. Maximum particulate concentration from Unit 2 corridor = 15 $\mu g/m^3$.	Similar effect.	Slight to moderate impact on ambient particulate concentrations from construction of Unit 1 and slight impact from Unit 2.
Noise	Onsite construction activities.	Ambient noise levels affected by equipment operation and increased traffic. Estimated ambient levels prior to construction: L_d = 56 dB(A) L_n = 51 dB(A) L_{dn} outdoors = 59 dB(A)	Same. Estimated ambient levels prior to construction: L_d = 51 dB(A) L_n = 35 dB(A) L_{dn} outdoors = 50 dB(A)	Impact during the 12-year construction period will be greater on the Breckinridge site due to lower ambient levels. Noise will be source of annoyance to residents in the immediate area of either site.
	Operation of generating station facilities.	Maximum predicted continuous effect on offsite areas from plant operation is 55 dB(A). Area expected to experience maximum effect is north of the Unit 2 cooling tower where Ky. 1406 and the L & N railroad switchyard are located. L_{dn} outdoors in this area, which is between the Willamette Industries plant and the generating station, is expected to be 61 dB(A). Both this L_{dn} level and the assumed	Maximum predicted continuous effect on offsite areas from plant operation is 56 dB(A). Maximum level is expected to occur south of the cooling towers. No continuous major sources on this site are comparable with industrial noises existing at the Hancock site, and L_{dn} levels are lower. One occupied dwelling within the maximum level area is expected to be affected.	Station-related noise levels in areas of public access outside the plant boundaries are expected to be within acceptable ranges. Most effects on ambient noise levels and noise perception will occur on or near the project location. Impact on background noise will be greater on the Breckinridge site, although synfuel development would preclude this. Impact on

Table 3.2-2. The Atmosphere and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 5 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Noise (Cont.)		existing L_{dn} outdoors of 59 dB(A) exceed the EPA guideline of 55 dB(A), which is outdoor level in residential areas compatible with protection of public health and welfare. Both levels are below the guideline of $L_{eq(24)}$ = 70 dB(A) for protection against hearing loss. One occupied residence will be subjected to highest noise levels from the plant, while a few dwellings farther away but within the maximum impact area will experience lower noise levels due to vegetation barriers.		nearby residents is expected to be similar on both sites. Impacts will continue throughout the life of the generating station.
	Operation of 345-kV transmission system.	Potential for slight buzzing noise directly under lines, especially during inclement weather.	Same.	No significant impact expected throughout operation.

3.3 LAND

Land areas that will be directly affected by the power plant are in Hancock, Hardin, and Breckinridge counties.

3.3.1 Physiography and Geology

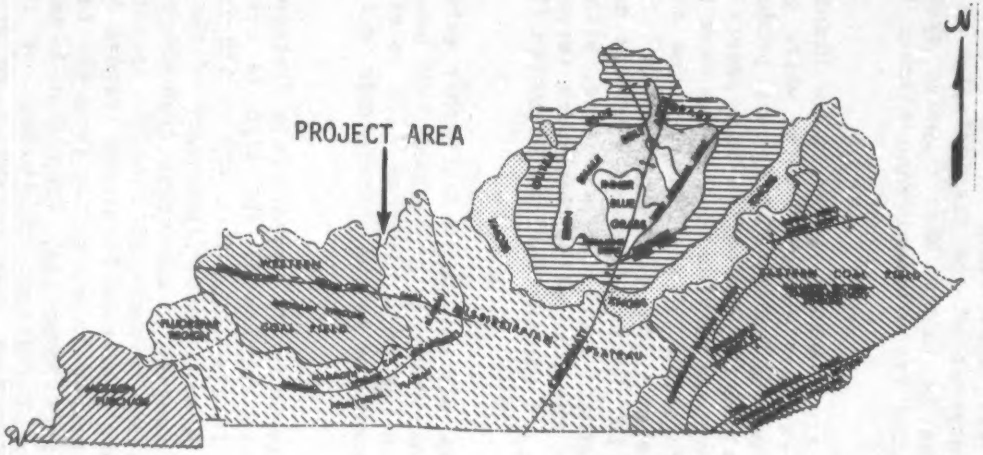
Baseline. The three Kentucky counties of the project area lie in two physiographic regions (Figure 3.3-1): the Western Coal Field (Hancock County) and the Mississippian Plateau (Breckinridge and Hardin counties). Elevations are lowest in the alluvial valley of the Ohio River and highest near the Dripping Springs Escarpment of the Mississippian Plateau. Geologically, most of the project area is in the Mississippian system, with Hancock and Breckinridge counties in the transitional zone between Mississippian and Pennsylvanian systems.

Although elevations are somewhat higher in the Mississippian Plateau, relief is more pronounced in eastern Hancock County, where gorge-like valleys and steep, rocky cliffs (including Jeffry Cliff) are produced by resistant sandstones and conglomerates along the Pottsville Escarpment. The Hancock site boundary is adjacent to the northern section of the Glen Dean Limestone outcrop, which is the oldest exposed formation in the county. The northern portion of the site is alluvium with elevations ranging from 390 to 430 feet msl. Pleistocene terrace deposits in the northeastern portions have elevations of 400 to 450 feet msl. The southern portion of the site, with elevations up to 680 feet msl, is underlain by the Caseyville Sandstone (around Jeffry Cliff), the Buffalo Wallow Formation, and the Tar Springs Formation (Figure 3.3-2); the strata dip to the west.

The Hancock site has one concealed fault that extends southwesterly and lies approximately 2000 feet west of the highway 1406 boundary. In Hancock County, the fault extends from the Ohio River to near Goering in the central part of the county, with the downthrow on the western side of the fault (Kentucky Geologic Survey 1978).

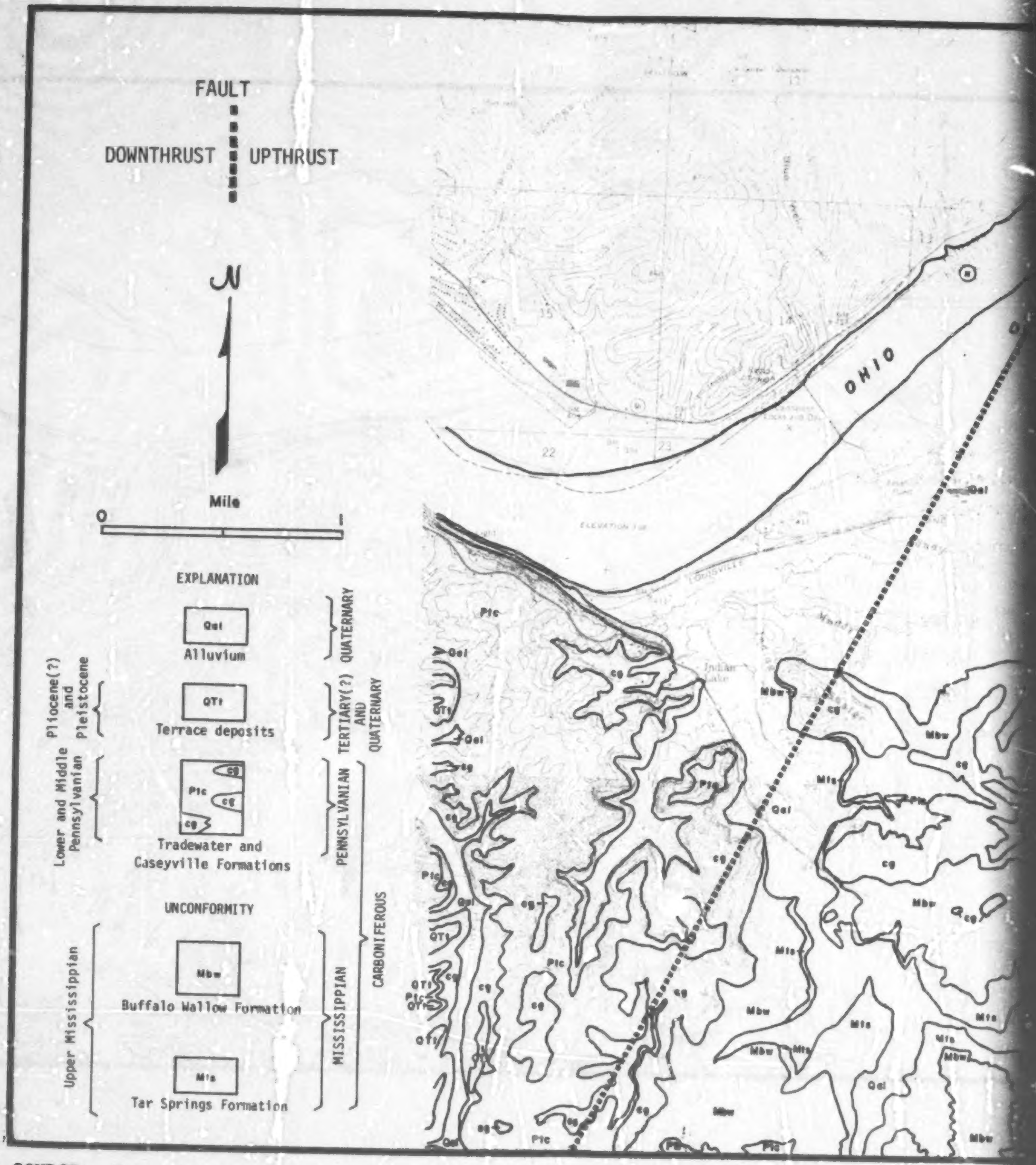
The Breckinridge site is in the Mammoth Cave Plateau of the Mississippian Plateau. The northwestern portion of the site is composed of alluvium and terrace deposits ranging in elevation from 400 to 450 feet msl. Alluvium along Town Creek extends to the east central boundary of the site. The northeastern portion of the site, ranging in elevation from 450 to 600 feet msl, is underlain by shale and sandstone members of the Tar Springs Formation, Glen Dean Limestone, and Hardinsburg Sandstone Formation (Figure 3.3-3). The southeastern portion of the site ranges in elevation from 450 to 700 feet msl and is underlain by the Tar Springs Formation, Glen Dean Limestone, Hardinsburg Sandstone, and Buffalo Wallow Formation. Elevations of the Buffalo Wallow Formation rise to over 800 feet msl just to the south of the site boundary within the transmission corridor area.

Elevations along the Elizabethtown corridor range from 425 feet msl near Cloverport to 905 feet msl near Dyer in western Hardin County where the Dripping Springs Escarpment separates the Mammoth Cave Plateau and the second member of the Mississippian Plateau, the Pennyroyal Plateau. Elevations along most of the corridor range from 650 to 800 feet msl.


PROJECT AREA
N
WESTERN
COAL FIELD
MISSISSIPPIAN
PLATEAU
KNOBS
BLUE GRASS
EASTERN COAL FIELD

SOURCE: Kentucky Geologic Survey (1966)

Figure 3.3-1. Physiographic Regions of Kentucky


FAULT
DOWNTHRUST
UPTHRUST
N
Mile
0
1
EXPLANATION
Qal
Alluvium
QUATERNARY
Pliocene(?) and Pleistocene
QTt
Terrace deposits
TERTIARY(?) AND QUATERNARY
Lower and Middle Pennsylvanian
Ptc
cg
Tradewater and Caseyville Formations
PENNSYLVANIAN
CARBONIFEROUS
UNCONFORMITY
Upper Mississippian
Mbw
Buffalo Wallow Formation
MISSISSIPPIAN
Mts
Tar Springs Formation
OHIO
Indian Lake
LOUISVILLE
ELEVATION
15
14
22
23

SOURCE: Kentucky Geological Survey (1956a)

Figure

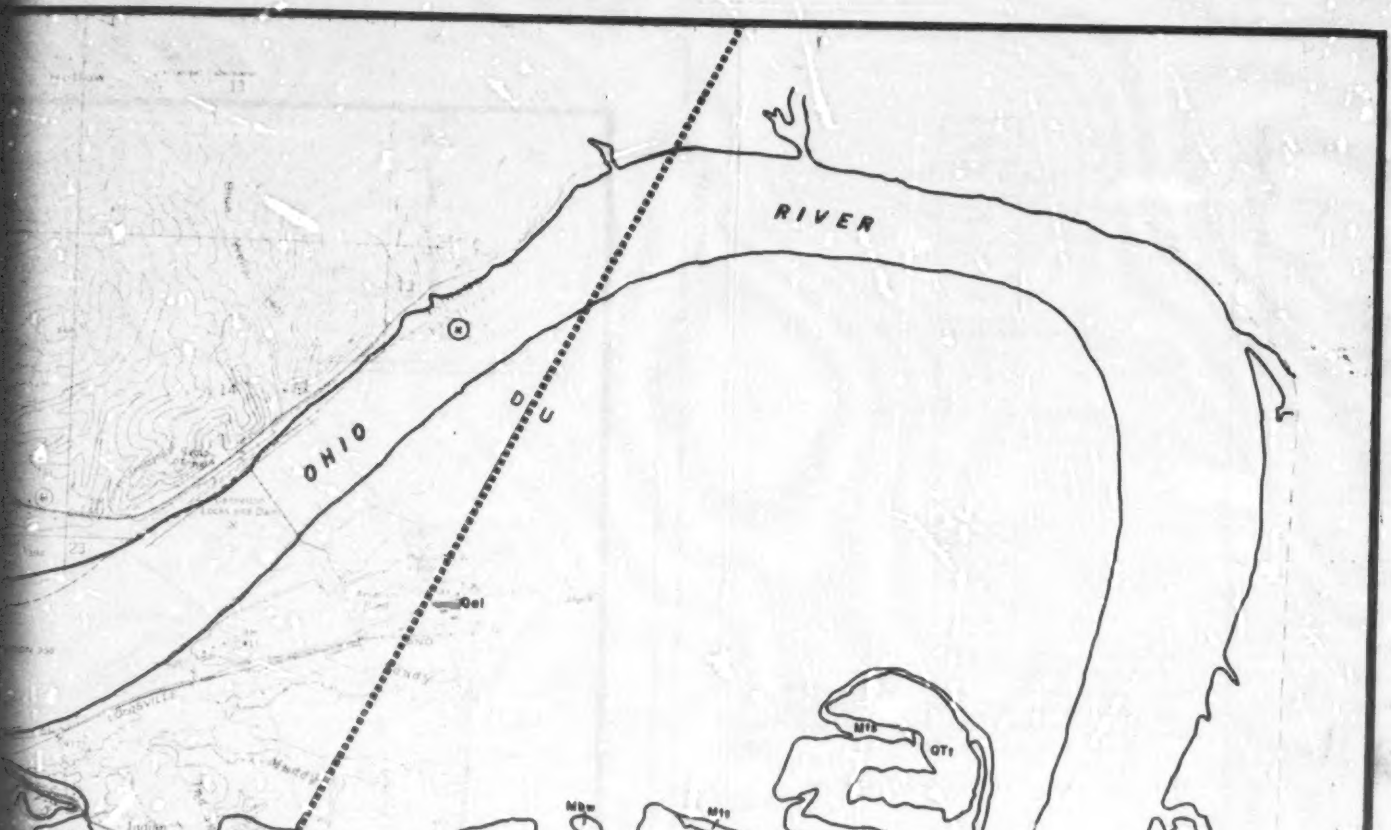
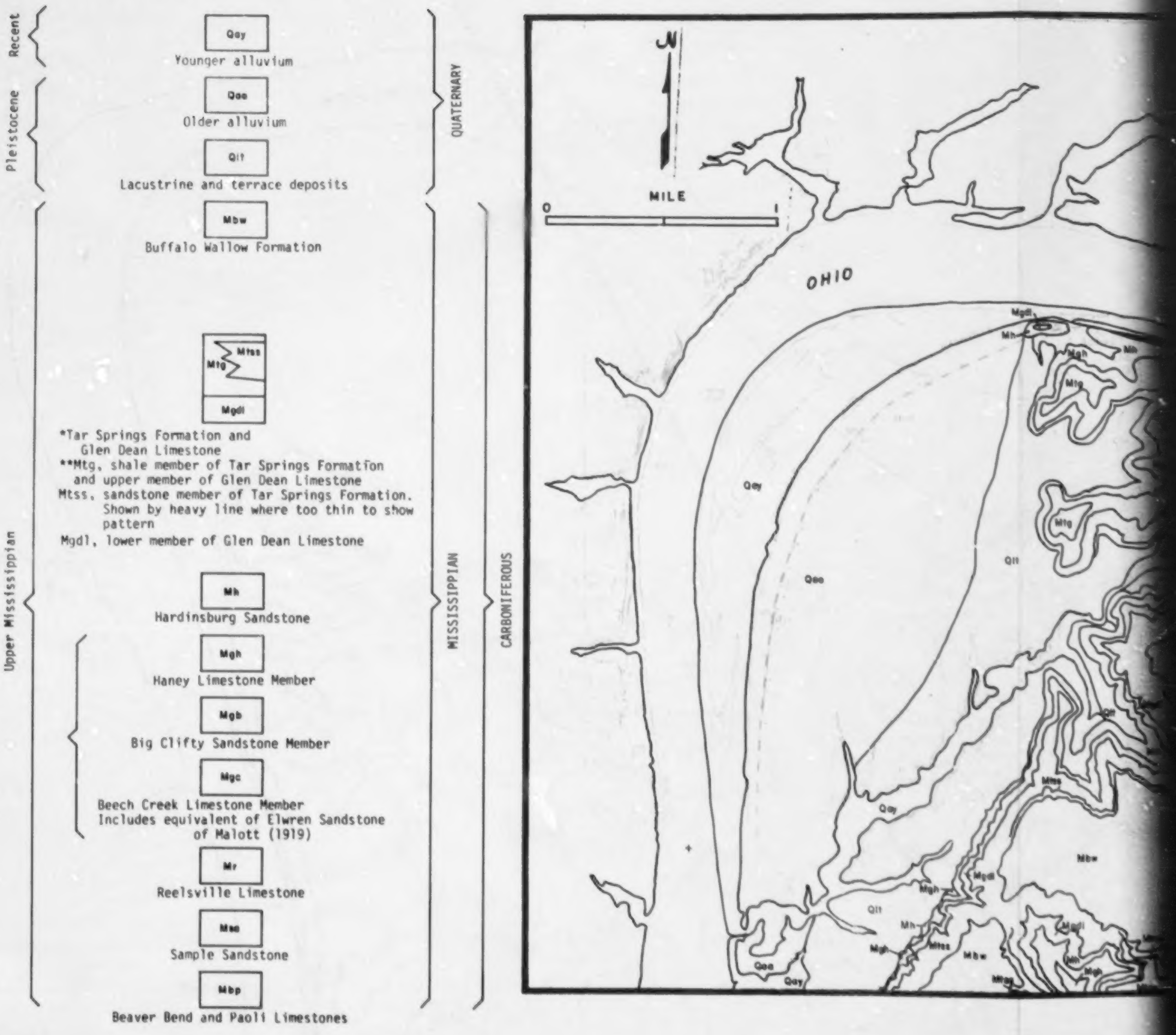

OHIO
RIVER
D
U
Qal
Mbw
Mfs
QTf
cg
Ptc
Indian Lake

Figure 3.3-2. Geology of the Hancock Site


Recent
Pleistocene
Upper Mississippian
QUATERNARY
MISSISSIPPIAN
CARBONIFEROUS
Qay
Younger alluvium
Qao
Older alluvium
Qlt
Lacustrine and terrace deposits
Mbw
Buffalo Wallow Formation
Mtg
Mtss
Mgdl
*Tar Springs Formation and Glen Dean Limestone
**Mtg, shale member of Tar Springs Formation and upper member of Glen Dean Limestone
Mtss, sandstone member of Tar Springs Formation. Shown by heavy line where too thin to show pattern
Mgdl, lower member of Glen Dean Limestone
Mh
Hardinsburg Sandstone
Mgh
Haney Limestone Member
Mgb
Big Clifty Sandstone Member
Mgc
Beech Creek Limestone Member Includes equivalent of Elwren Sandstone of Malott (1919)
Mr
Reelsville Limestone
Msa
Sample Sandstone
Mbp
Beaver Bend and Paoli Limestones
N
MILE
0
1
OHIO
Mgdl
Mh
Mgh
Mtg
Qay
Qao
Qlt
Mtss
Mbw
Qay
Qao

SOURCE: Kentucky Geological Survey (1956b)

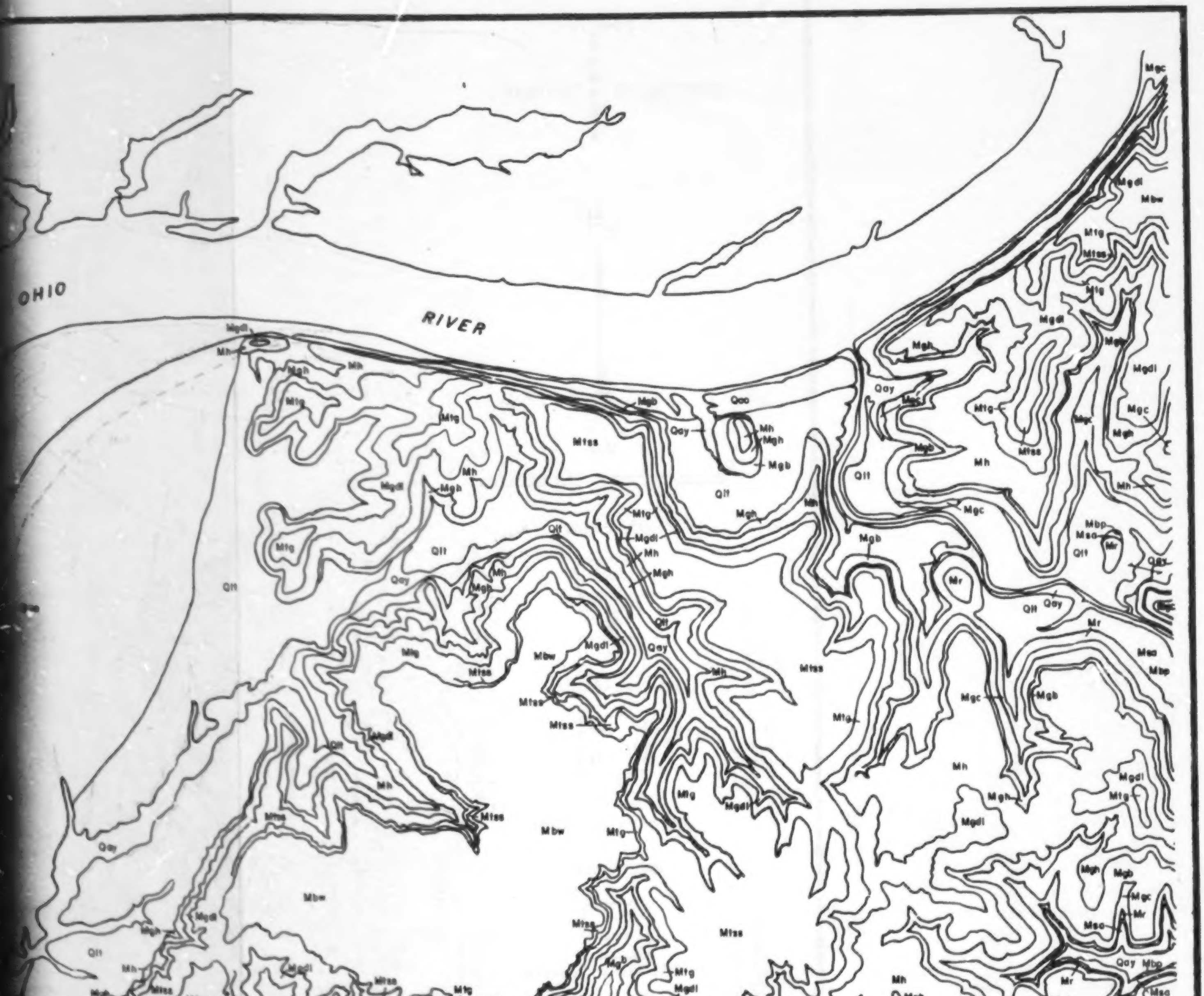

OHIO
RIVER
Mgc
Mgdl
Mbw
Mtg
Mtss
Mgb
Mh
Mgh
Qao
Qay
Qlt
Mr
Mbp
Msa
Mgdl
Mtg
Mtss
Mh
Mgh
Mbw

Figure 3.3-3. Geology of the Breckinridge Site

The most prominent fault system in the vicinity of the project is the Rough Creek Fault Zone, which lies about 30 miles south of the sites. Fault patterns in this zone are generally complex, with structural displacement indicating movement along the fault system as post-Pennsylvanian and pre-tertiary. Magnitude-recurrence for earthquakes in the central Mississippi Valley indicates a level of seismicity in which a given magnitude is about one tenth as frequent as an equivalent earthquake in active seismic zones in the western United States. The 1976 Uniform Building Code Seismic Zone Map of the United States places the Hancock and Breckinridge sites in Zone 2, which is indicative of moderate damage, corresponding to Modified Mercalli intensity VII or Richter scale 5:

> Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver; furniture breaks; weak masonry, including cracks, damaged; weak chimneys break at roof line; plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments) fall; some cracks in ordinary masonry; waves on ponds; water turbid with mud; small slides and caving in along sand or gravel banks; large bells ring; concrete irrigation ditches damaged.

On July 27, 1980, an earthquake estimated at 5.1 Richter magnitude was centered at Maysville, Kentucky, southeast of Cincinnati, about 165 miles ENE of the sites. The Hancock Clarion reported awareness of the tremor in the county. Prior to this earthquake, the largest tremor in northern Kentucky, which occurred in 1933, measured Richter magnitude 4.2.

Impacts. No significant adverse impacts on geology are expected, but topography of the developed site will be irreversibly altered (Table 3.3-6).

3.3.2 Soils

Baseline. The soils of the project area vary with the topography. Soils along the Ohio River developed from alluvial and outwash deposits. Upland soils are discontinuous loess over weathered sandstone, shale, and limestone of varying depths and physical composition. Suitability of soil for various uses is related to slope, fertility, and drainage of the land.

The rolling hills and uplands of Hancock County, Breckinridge County, and western Hardin County have deep to moderately deep soils formed in residuum from acid shales, siltstones, and sandstones. In central Hardin County, the soils are similar except they were formed in residuum from limestone. The most extensive soil association on the uplands in Hancock and western Breckinridge counties is the Zanesville-Frondorf association. In eastern Breckinridge and western Hardin counties the Caneyville-Zanesville-Frondorf association is more common. The Crider-Cumberland association is most common in the vicinity of Elizabethtown.

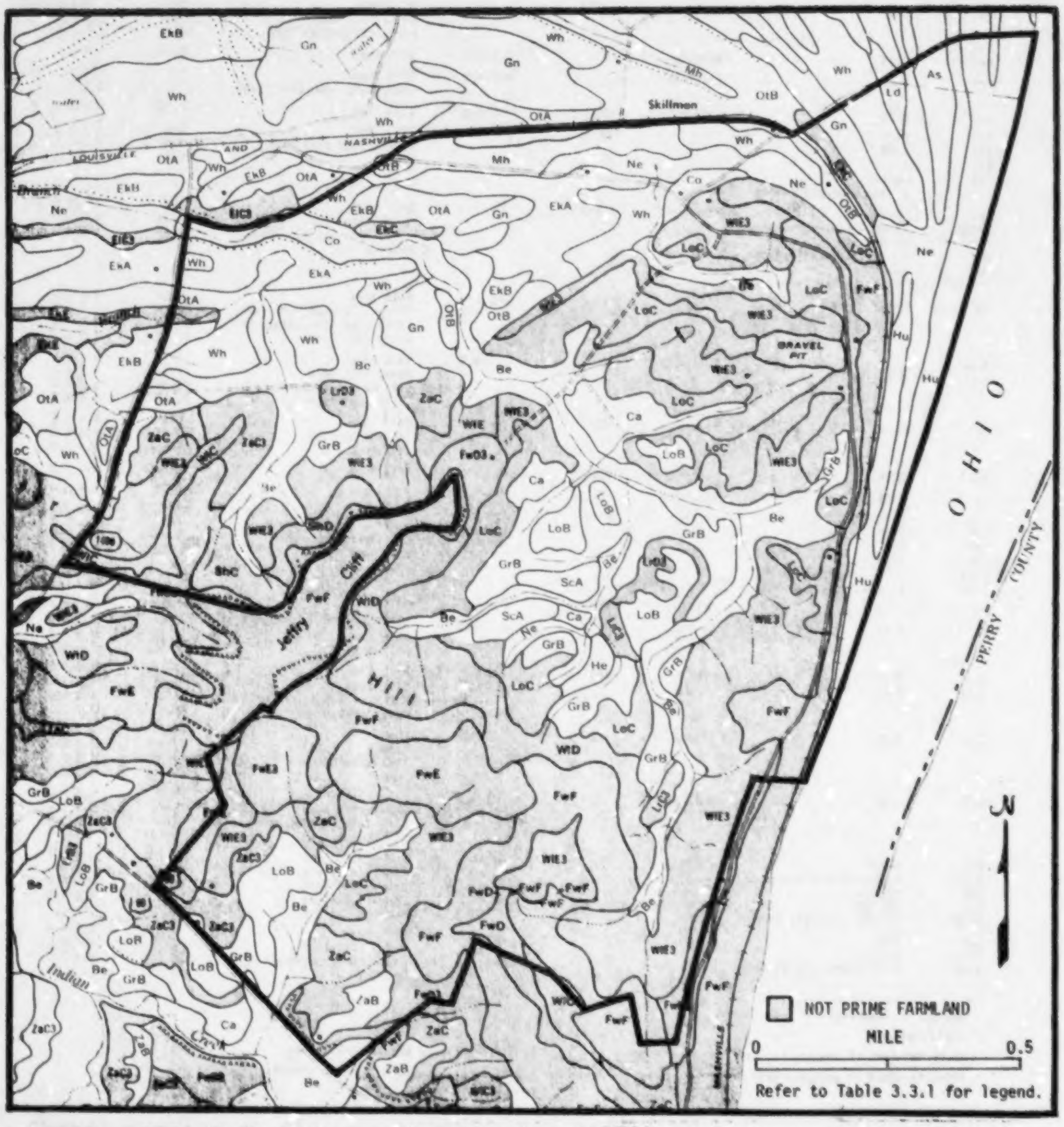
Along the nearly level floodplains and lower terraces of the Ohio River the soils range from deep, well drained to poorly drained. The most common association on these alluvial areas in Hancock and Breckinridge counties is the Elk-Weinbach-Melvin association.

A description of the Hancock site soils based on a Soil Conservation Service survey of the county revealed that many of the soil types have been designated as prime farmland soils by the Kentucky State Conservationist (Figure 3.3-4 and Table 3.3-1). To qualify as prime farmland, some of these soils must be subject to less frequent flooding than once in 2 years during the growing season and/or must have adequate drainage to a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown. Onsite investigation may be needed to determine whether the soils are classifiable as prime farmland. Soils of the ridges in the southern portion of the site, those associated with Jeffry Cliff, and certain soils in the northeastern portion of the site are not prime farmland.

Although the Soil Conservation Service survey of Breckinridge County soils is incomplete, many of the soil types identified to date at the Breckinridge site have been designated as prime farmland soils (Figure 3.3-5; Table 3.3-2). Again, primarily because of flooding characteristics, an onsite investigation probably would be necessary for a determination of prime farmland status. Breaks and alluvial land along the western and northwestern edge of the site and soils occupying steep slopes in the eastern portion of the site are not prime farmland.

Impacts. The existing soil resource will be essentially lost in all portions of the site where major construction occurs (Table 3.3-6). Once the profile is destroyed and upper layers removed, the soil cannot be returned to its preconstruction condition. During grading, topsoil and subsoil are mixed, and valuable organic matter in the topsoil is lost. The biological productivity of the new surface is reduced, texture is altered, and soil moisture generally is lowered. If done, removal and stockpiling of topsoil will save part of the soil resource for landscaping around major facilities and for aiding revegetation of landfill areas. However, certain physical, chemical, and biological changes occur during storage that diminish soil productivity so that loss of topsoil resource is reduced but not completely prevented. Also, the natural profile is disrupted even when topsoil is saved. Alteration of the profile prevents the reestablishment of existing natural vegetation communities, especially certain forest associations.

Disposal of dry stabilized wastes in landfill areas should result in a low to moderate probability of soil contamination. There will be virtually no seepage of waste liquors from the dry wastes, so that leaching by rainfall will be the primary mode of materials movement. Although no leaching data are available on the precise waste product proposed by KU, known soils characteristics of the disposal sites indicate a high probability of infiltration from whatever leaching may occur. Waste will be deposited directly on the soil, which is loamy in nature, in an area where average annual precipitation is 44.4 inches. Although the soils are only moderately permeable, rainfall is high, and the seasonal high water table is shallow in many of the soils. When the seasonal water table is less than 9.9 feet from the soil surface, the area is usually considered a poor site for ash and sludge waste disposal. Four of the soil types on the Hancock site can have water tables as shallow as 0.5 feet from the surface. Only soils in the Frondorf and Wellston series having water tables greater than 6 feet deep could have levels approaching the 9.9 foot depth. Thus, some infiltration of trace elements from solid waste landfill areas appears likely, even though the wastes will be deposited in a dry state. Leachates from the stabilized product generally are considered nonhazardous in drinking water (see Section 3.4.2). Over the long term, trace element concentrations in plants will increase, with the degree of physiological disturbance dependent on existing concentrations (Table 3.3-6).


OHIO
PERRY COUNTY
Skillman
Jeffry Cliff
Hill
GRAVEL PIT
Indian Creek
Louisville and Nashville
▢ NOT PRIME FARMLAND
MILE
0
0.5
Refer to Table 3.3.1 for legend.
N

SOURCE: USDA Soil Conservation Service (1974)
USDA Soil Conservation Service, State Conservationist for the Commonwealth of Kentucky (1979)

Figure 3.3-4. Soil Associations, Hancock Site

Table 3.3-1. Soil Types, Hancock Site

Map Unit	Slope	Soil Series	Depth to Bedrock (feet)	Depth to Seasonal High Water Table (feet)	Texture	Depth from Surface (inches)	Reaction pH
As[1,2]	0-4%	Ashton	>50	>3	Silt loam	0-7	7.3-7.8
					Silty clay loam	7-54	5.5-7.3
					Heavy silty clay loam	54-60	5.5-6.5
Be[1,3,4]	0-2%	Belknap	>7	0.5-1.5	Silt loam	0-50	4.5-5.5
Ca[4]	0-4%	Calloway	>4	0.5-1.5	Silt loam	0-27	5.5-6.0
					Heavy silt loam (fragipan)	27-50	5.0-6.5
Co[1,3]	0-2%	Collins	>10	1.5-3.0	Silt loam	0-60	4.5-5.5
EkA[2]	0-2%	Elk	>50	>6	Silt loam	0-8	5.6-6.0
EkB[2]	2-6%				Light silty clay loam	8-36	4.5-5.0
EkC	6-12%				Loam	36-50	5.1-5.5
EkE	12-50%						
ElC3	6-12%, severely eroded						
FWD	12-20%	Frondorf	1.5-3.5	>6	Silt loam	0-7	4.5-6.0
FWD3	12-20%, severely eroded				Silty clay loam	7-18	4.5-6.0
FWE	20-30%				Gravelly silty clay loam	18-30	4.5-6.0
FWE3	20-30%, severely eroded				Bedrock	30	–
FWF	30-50%						
For Wellston part, see Wellston series							
Gn[4]	0-2%	Ginat	>50	0-0.5	Silt loam	0-20	4.5-6.0
					Heavy silt loam (fragipan)	20-26	4.5-6.0
					Silty clay loam (fragipan)	26-40	4.5-6.0
					Silty clay loam	40-52	4.5-6.0
GrA[2]	0-2%	Granada	>6	1.5-2.5	Silt loam	0-7	5.6-6.0
GrB[2]	2-6%				Heavy silt loam	7-22	5.1-6.0
					Silt loam (fragipan)	22-36	5.1-6.0
					Silty clay loam	36-50	5.1-6.5
He[4]	0-4%	Henshaw	>20	1-2	Silt loam	0-9	6.1-6.5
					Silty clay loam	9-45	5.0-6.5
					Silt loam	45-60	6.1-7.8
Hu[1,3]	0-4%	Huntington	>50	>3	Silt loam	0-60	6.1-7.8
Ld[1,3]	0-2%	Lindside	>20	1.5-3.0	Silt loam	0-50	5.6-6.5
LoA	0-2%	Loring	6-12	2-6	Silt loam	0-7	5.6-6.0
LoB	2-6%				Light silty clay loam	7-30	5.1-6.0
LoC	6-12%				Silt loam (fragipan)	3-54	5.1-5.5
LoD	12-25%				Silt loam	54-60	5.1-6.5
LrC3	6-12%, severely eroded						
LrD3	12-25%, severely eroded						
Mh[1,3,4]	0-2%	Melvin	>50	0-0.5	Silt loam	0-50	6.1-6.5
Ne[1,3,4]	0-2%	Newark	>20	0.5-1.5	Silt loam	0-9	5.6-6.0
					Silt loam	9-32	5.6-7.3
					Silt loam	32-60	5.6-7.8
OtA[2]	0-2%	Otwell	>50	1.5-2.5	Silt loam	0-7	5.6-6.0
OtB[2]	2-6%				Silt loam	7-26	4.5-5.0
					Heavy silt loam (fragipan)	26-40	4.5-5.0
					Heavy silt loam	40-60	5.1-5.5
ScA[2]	0-2%	Sciotoville	>50	1.5-2.5	Loam	0-7	6.1-6.5
					Loam	7-27	4.5-5.0
					Loam (fragipan)	27-52	4.5-5.0
					Loam	52-60	4.5-5.0
Wh[3,4]	0-2%	Weinbach	>50	0.5-1.5	Silt loam	0-8	5.6-6.0
					Heavy silt loam	8-24	4.5-5.5
					Silt loam (fragipan)	24-40	4.5-5.0
					Silty clay loam	40-50	5.1-5.5
WlC	6-12%	Wellston	3-6	>6	Heavy silt loam	0-5	5.6-6.0
WlC3	6-12%, severely eroded				Light silty clay loam	5-26	5.1-5.5
WlD	12-20%				Heavy silt loam	26-40	4.5-5.0
WlE	20-30%				Fine sandy loam	40-60	4.5-5.0
WlE3	12-30%, severely eroded				Bedrock	60	–
ZaB[2]	2-6%	Zanesville	4-6	2-2.5	Silt loam	0-8	4.5-5.5
ZaC	6-12%				Heavy silt loam	8-26	4.5-5.5
ZaC3	6-12%, severely eroded				Silt loam (fragipan)	26-60	4.5-5.5
					Bedrock	60	–

---

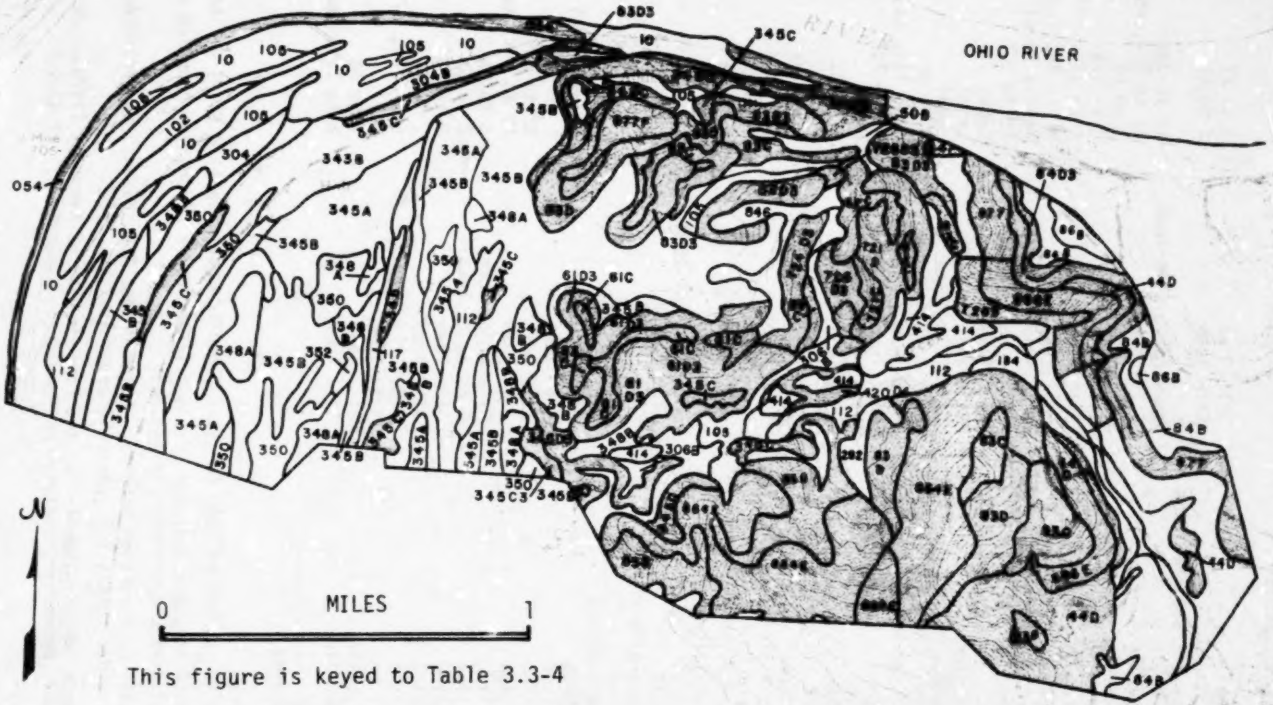
[1] Subject to flooding.

[2] Prime farmland.

[3] Prime farmland if subject to less frequent flooding than once in 2 years during the growing season.

[4] Prime farmland if adequate drainage to a sufficient depth during the cropping season to allow growth of cultivated crops

Sources: USDA Soil Conservation Service (1974); Soil Survey of Daviess and Hancock Counties, Kentucky; SCS State Conservationist for the Commonwealth of Kentucky (1979); Prime Farmland Soils of Kentucky. Kentucky Inventory and Monitoring Bulletin No. KY42-9-4.


OHIO RIVER
RIVER
MILES
0
1
8303
10
345C
105
106
102
304
3049
345C
343B
345A
345B
345B
345A
348A
054
105
380
350
345B
348
A
350
348
117
352
345B
348A
345B
112
345A
350
348A
345B
350
345C3
346B
112
350
6103
61C
61
03
345C
105
3068
414
112
414
120D4
184
112
8303
84C
8303
877F
508
877
8403
869
44D
84B
86B
84B
877
44D
44D
84B
83C
83D
83D

This figure is keyed to Table 3.3-4

Not Prime Farmland

SOURCE: USDA Soil Conservation Service, Personal communication (1980)
USDA Soil Conservation Service, State Conservationist
for the Commonwealth of Kentucky (1979)

Figure 3.3-5. Soil Associations, Breckinridge Site

Table 3.3-2. Preliminary Soil Types, Breckinridge Site

Map Unit	Soil Series	Texture	Slope
304[1,2]	Ashton	Silt loam	0 to 2%
304B[2]	Ashton	Silt loam	2 to 6%
054	Breaks and alluvial land	—	—
724D	Caneyville	Very rocky silt loam	12 to 20%
726D3	Caneyville	Silty clay	12 to 20%, severely eroded
306B[2]	Captina	Silt loam	2 to 6%
721C	Christian	Silt loam	6 to 12%
61C	Crider	Silt loam	6 to 12%
61D3	Crider	Silt loam	12 to 20%, severely eroded
102[1,3]	Egam	Silt loam	Nearly level
864E	Gilpin	Silty clay loam	20 to 30%
352[4]	Ginat	Silt loam	Level
10[1,3]	Huntington	Silt loam	Level
105[1,3]	Lindside	Silt loam	Level
414[3,4]	McGary	Silt loam	0 to 2%
420C3	Markland	Silt loam	6 to 12%, severely eroded
420D9	Markland	Silt loam	12 to 20%
117[1,3,4]	Melvin	Silt loam	Level
50B[2]	Memphis	Silt loam	2 to 6%
112[1,3,4]	Newark	Silt loam	Level
60C	Pembroke	Silt loam	6 to 12%
62C	Russelville	Silt loam	6 to 12%
86B[2]	Sadler	Silt loam	2 to 6%
348A[2]	Sciotoville	Silt loam	0 to 2%
348B[2]	Sciotoville	Silt loam	2 to 6%
44D	Shelocta	Gravelly silt loam	12 to 20%
184[3,4]	Stendal	Silt loam	Level
886	Weikert-Gilpin	Stony soils	15 to 50%
877	Weikert	Stony soils	15 to 50%
886E	Weikert-Gilpin	Stony soils	20 to 30%
350[3,4]	Weinbach	Silt loam	Nearly level
83C	Wellston	Silt loam	6 to 12%
83D	Wellston	Silt loam	12 to 20%
83D3	Wellston	Silt loam	12 to 20%, severely eroded
343A[2]	Wheeling	Fine sandy loam	0 to 2%
343B[2]	Wheeling	Fine sandy loam	2 to 6%
345A[2]	Wheeling	Silt loam	0 to 2%
345B[2]	Wheeling	Silt loam	2 to 6%
345C3	Wheeling	Silty clay loam	6 to 12%, severely eroded
345D	Wheeling	Silt loam	—
84B[2]	Zanesville	Silt loam	2 to 6%
84C3	Zanesville	Silt loam	6 to 12%, severely eroded

---

[1] Subject to flooding.

[2] Prime farmland.

[3] Prime farmland if subject to less frequent flooding than once in 2 years during the growing season.

[4] Prime farmland if adequate drainage to a sufficient depth during the cropping season to allow growth of cultivated crops common to the area.

Sources: USDA Soil Conservation Service. Breckinridge County Kentucky Preliminary Soil Survey Data. Breckinridge County SCS, personal communication, 1980.

SCS State Conservationist for the Commonwealth of Kentucky (1979). Prime Farmland Soils of Kentucky. Kentucky Inventory and Monitoring Bulletin No. KY 42-9-4.

Leaching from the uncovered, unlined coal and limestone storage piles and retention basins also is probable. The pH range for soils in these areas on the Hancock site is 4.5 to 6.0, making them slightly acidic and sensitive to alkaline leachate.

3.3.3 Vegetation

Baseline. The project area is in the Western Mesophytic Forest of the eastern North American Deciduous Forest Formation. It is a transition region where mixed mesophytic forests that dominate eastern Kentucky become limited in extent, and oak forests become frequent and dominant. Land use changes, poor land use practices, and other sources of soil or topographic alteration favor reestablishment of oak forests, so that areas of mixed mesophytic communities have become even more limited. The ravine slopes with deep soils around Jeffry Cliff comprise the only habitat supporting a mixed mesophytic community on either site.

The most extensive vegetation cover in the 3-county project area is upland hardwoods, primarily composed of oak-hickory forests. The largest areas of upland hardwoods are in the Hoosier National Forest and along the Hancock transmission corridor. Lowland hardwoods, characterized by sycamore, yellow poplar, sweetgum and red maple among others, are not extensive and often consist of little more than a band of streamside trees. Coniferous forests, a minor cover type, are mainly plantings of shortleaf, white, and red pine, with much of the shortleaf pine cold-stressed because it is north of its natural range.

Cultivated fields and fallow fields (idle cropland or pasture) are the major components of agricultural land, which is about 1/3 of the project area and the major cover type on both sites (Figures 3.1-2 and 3.1-3). Soybean cultivation is common on alluvial flats and lower terraces of the Ohio River, while corn and tobacco are more common on gently rolling hills and plateaus. Fallow fields, characterized by grasses and forbs, occupy poorly drained or erosion-prone locations. When not grazed, this vegetation may be cut for hay.

Old fields, characterized by a greater number of perennial herbaceous species than found in fallow fields and presence of shrubs and trees such as winged sumac and eastern redcedar, are sparse and widely scattered throughout the project area. Wetlands, primarily wetland embayments created by elevation of the river following construction of the Cannelton Lock and Dam, are another minor cover type. There are 19 wetland embayments near the sites, 12 of which are on the Indiana side of the river. Two on the Kentucky side are below the Hancock site near RM 721 and two of the largest on the Kentucky side (Town Creek and Bull Creek) are below the Breckinridge site near RM 707. Two type 5 wetlands, which are identified by the Kentucky Department of Fish and Wildlife Resources as inland open fresh water, are located near the Hancock site: Indian Lake and a small lake near Muddy Branch west of highway 1406. Additionally, a small (4 acres) freshwater marsh dominated by willows, silver maple, smartweed, and buttonbush, is located inside the northern boundary of the Hancock site.

A 1979-1980 survey of the project area cover types revealed 200 plant species (Table 3.3-3). None of the plants observed is Federally designated endangered or threatened or on the Kentucky Nature Preserves Commission Plant Element List; further, no records exist of these species on either site, either potential transmission corridor, or the Elizabethtown corridor.

Table 3.3-3. Checklist of Plant Species Observed in the Project Area, 1979-1980 (Sheet 1 of 3)

Scientific Name	Common Name	Scientific Name	Common Name
Acer negundo	Boxelder	Carya cordiformis	Bitternut hickory
Acer rubrum	Red maple	Carya glabra	Pignut hickory
Acer saccharinum	Silver maple	Carya ovata	Shagbark hickory
Acer saccharum	Sugar maple	Carya tomentosa	Mockernut Hickory
Achillea millefolium	Milfoil (yarrow)	Carya sp.	Hickory
Actaea alba	White baneberry	Celtis occidentalis	Hackberry
Actinomeris alternifolia	Wingstem	Cephalanthus occidentalis	Buttonbush
Aesculus glabra	Ohio buckeye	Cerastium vulgatum	Mouse-ear chickweed
Agrimonia mollis	Agrimony	Cercis canadensis	Redbud
Agrimonia parviflora	Swamp agrimony	Chichorium intybus	Chickory
Allium canadense	Wild onion	Chimaphila maculata	Spotted wintergreen
Ambrosia artemisifolia	Ragweed	Cinna arundinacea	Wood reed
Andropogon virginicus	Broom sedge	Cirsium vulgare	Bull thistle
Anemonella thalictroides	Windflower	Claytonia virginica	Spring beauty
Antennaria solitaria	Pussy-toes	Convolvulus arvensis	Field bindweed
Aralia spinosa	Hercules club	Cornus florida	Flowering dogwood
Arisaema dracontium	Green dragon	Cryptotaenia canadensis	Honewort
Arisaema triphyllum	Jack in the pulpit	Cyperus esculentus	Nut grass
Aristida sp.	Three awn grass	Cystopteris bulbifera	Bulblet bladder fern
Asarum canadense	Wild ginger	Cystopteris fragilis	Bladder fern
Asimina triloba	Pawpaw	Daucus carota	Queen Anne's lace
Asplenium platyneuron	Ebony spleenwort	Delphinium tricorne	Dwarf larkspur
Aster lateriflorus	Calico aster	Dentaria heterophylla	Slender toothwort
Aster sp.	Aster	Dentaria laciniata	Cut-leaved toothwort
Asteraceae		Desmodium paniculatum	Panicled tick trefoil
Bidens bipinnata	Spanish needles	Desmodium perplexum	Beggar lice
Boehmeria cylindrica	False nettle	Dicentra canadensis	Squirrel corn
Botrychium obliquum	Common grapefern	Dicentra cucullaria	Dutchman's breeches
Botrychium virginianum	Rattlesnake fern	Dicotyledonae	
Brachyelytrum erectum	Bearded shorthusk	Digitaria filiformis	Crab grass
Campsis radicans	Trumpet vine	Diodia teres	Buttonweed
Carex pensylvanica	Pennsylvania sedge	Dioscorea quarternata	Wild yam
Carex sp.	Sedge	Diospyros virginiana	Persimmon
Carpinus caroliniana	American hornbeam	Dryopteris marginalis	Marginal shield-fern

Table 3.3-3. Checklist of Plant Species Observed in the Project Area, 1979-1980 (Sheet 2 of 3)

Scientific Name	Common Name	Scientific Name	Common Name
Dryopteris sp.	Woodfern	*Liquidambar styraciflua*	Sweetgum
Eleocharis sp.	Spike rush	*Liriodendron tulipifera*	Yellow poplar
Equisetum hyemale	Scouring rush	*Lonicera japonica*	Japanese honeysuckle
Erechtites hieracifolia	Fireweed	*Morus rubra*	Red mulberry
Erigeron philadelphicus	Marsh fleabane	*Nyssa sylvatica*	Black gum
Erigeron strigosus	Daisy fleabane	*Opuntia humifusa*	Prickly pear cactus
Erythronium americanum	White trout lily	*Osmorhiza claytonia*	Sweet cicely
Euonymus americanus	Strawberry bush	*Oxalis stricta*	Wood sorrel
Eupatorium coelestinum	Mistflower	*Oxalis violacea*	Violet wood sorrel
Eupatorium perfoliatum	Common boneset	*Oxydendron arboreum*	Sourwood
Eupatorium rugosum	White snakeroot	*Panicum* sp.	Panic grass
Eupatorium sp.	Thoroughwort	*Parthenocissus quinquefolia*	Virginia creeper
Euphorbia maculata	Nodding spurge	*Phacelia bipinnatifida*	Phacelia
Fabaceae		*Phaseolus polystachios*	Wild bean
Fagus grandifolia	Beech	*Phryma leptostachya*	Lopseed
Festuca sp.	Fescue	*Pilea pumila*	Clearweed
Fraxinus americana	White ash	*Pinus echinata*	Shortleaf pine
Galium aparine	Cleavers	*Pinus resinosa*	Red pine
Galium circaezans	Wild licorice	*Pinus strobus*	White pine
Galium sp.	Bedstraw	*Pinus taeda*	Loblolly pine
Geum canadense	Avens	*Pinus virginiana*	Virginia pine
Gnaphalium obtusifolium	Rabbit tobacco	*Plantago lanceolata*	English plantain
Hepatica acutiloba	Liverleaf	*Plantago rugelii*	Red-stalked plantain
Houstonia sp.	Bluets	*Plantago virginica*	Dwarf plantain
Hydrangea arborescens	Hydrangea	*Platanus occidentalis*	Sycamore
Hydrocotyle sp.	Water pennywort	Poaceae	
Impatiens biflora	Jewelweed	*Podophyllum peltatum*	Mayapple
Ipomaea pandurata	Morning glory	*Polygala sanguinea*	Milkwort
Juglans cinera	Butternut	*Polygonatum biflorum*	Solomon's seal
Juncus dichotomus	Forked-rush	*Polygonum densiflorum*	Smartweed
Juniperus virginiana	Eastern redcedar	*Polystichum acrostichoides*	Christmas fern
Lespedeza cuneata	Sericea lespedeza	*Prenanthes* sp.	Rattlesnake root
Lespedeza sp.	Lespedeza	*Prunella vulgaris*	Self-heal
Lindera benzoin	Spicebush	*Prunus serotina*	Black cherry

Table 3.3-3. Checklist of Plant Species Observed in the Project Area, 1979-1980 (Sheet 3 of 3)

Scientific Name	Common Name	Scientific Name	Common Name
Pycnanthemum tenuifolium	Narrow-leaved mountain mint	Smilax glauca	Greenbriar
Quercus alba	White oak	Smilax hispida	Greenbriar
Quercus coccinea	Scarlet oak	Smilax sp.	Greenbriar
Quercus falcata	Southern red oak	Solanum carolinense	Horsenettle
Quercus muehlenbergii	Chinkapin oak	Solidago altissima	Goldenrod
Quercus prinus	Chestnut oak	Solidago juncea	Goldenrod
Quercus rubra	Northern red oak	Solidago rugosa	Goldenrod
Quercus velutina	Black oak	Solidago sp.	Goldenrod
Ranunculus arbortivus	Small-flowered buttercup	Sorghum halepense	Johnson grass
Ranunculus recurvatus	Hooked buttercup	Sparganium sp.	Bur-reed
Ranunculus sp.	Buttercup	Sullivantia sullivantii	Sullivantia
Rhus copallina	Winged sumac	Tilia americana	Basswood
Rhus glabra	Smooth sumac	Tradescantia subaspera	Spiderwort
Rhus radicans	Poison ivy	Trifolium pratense	Red clover
Robinia pseudoacacia	Black locust	Trifolium repens	White clover
Rubiaceae		Trifolium sp.	Clover
Rubus allegheniensis	Blackberry	Trillium sessile	Trillium
Rudbeckia hirta	Black-eyed Susan	Typha latifolia	Cattail
Rumex acetosella	Sheepsorrel	Ulmus alata	Winged elm
Sabatia angularis	Rose-pink	Ulmus americana	American elm
Salix nigra	Black willow	Ulmus rubra	Slippery elm
Salix sp.	Willow	Uniola latifolia	Spike grass
Sambucus canadensis	Elderberry	Veronia fasciculata	Common ironweed
Sanguinaria canadensis	Bloodroot	Verbena hastata	Blue vervain
Sassafras albidum	Sassafras	Verbena urticifolia	White vervain
Schizachne purpurascens	False-melic grass	Viburnum acerifolium	Arrow-wood
Sedum ternatum	Stonecrop	Vicia villosa	Hairy vetch
Setaria sp.	Foxtail grass	Vicia sp.	Vetch
Silene virginica	Firepink	Viola papilionacea	Common blue violet
Smilacina racemosa	False Solomon's-seal	Viola sororia	Woolly blue violet
Smilacina sp.		Vitis vulpina	Frost grape
		Xanthium strumarium	Cocklebur

Source: Texas Instruments Incorporated field data (1979-1980).

References: Radford et al. (1968).
Wharton and Barbour (1971).
Courtenay and Zimmerman (1972).
Wharton and Barbour (1973).

Vegetation stress in the project area also was surveyed during 1979-1980. Weather-induced stress of shortleaf pine, which is most widespread in the Hoosier National Forest, and insect-related stress (including that among pine plantings) were the most common forms of stress observed. There is no present documentation of stress from air pollution, although local officials suspect some damage has occurred, especially to white pine.

Impacts. The primary impact to vegetation from construction and operation of the generating station will be the permanent loss of existing vegetation on most of the site and the incremental regional loss as industrial land use increases (Table 3.3-6). Cover types that are able to establish on the reclaimed landfill areas will have lower economic, wildlife, and nutrient value than those currently existing in riparian and upland areas especially. Increased pollution levels will affect both onsite and offsite pollution-sensitive vegetation.

Those vegetation communities that will not readily establish on the sites because of topographic and soils alterations include lowland hardwoods, wet-site and marshy communities, and wetlands. Upland species and associations that will not reestablish because of their dependency on deep and fertile as well as moist soils include beech, maples, basswood, and yellow buckeye. Black walnut, white oak, and northern red oak may return but will not have suitable conditions for optimum growth and dominance in the community. All of these disturbance-sensitive communities are either only on the Hancock site or more extensive there (Table 3.3-6).

3.3.4 Wildlife

Baseline. The landforms and vegetation cover types provide a variety of habitats for the project area wildlife. Most of the common and abundant wildlife of the project area, as well as some less common species occur on the Hancock and Breckinridge sites (Tables 3.3-4 and 3.3-5). No Federally designated threatened or endangered species were observed on either site, either potential transmission corridor, or the Elizabethtown corridor, nor do records of their presence in these locations exist. On the Hancock site, 4 birds and one mammal on the Kentucky Nature Preserves Commission Animal Element list were observed (great blue heron, great egret, black vulture, marsh hawk, evening bat). On the Breckinridge site, 3 birds on the Commission's list were observed (black vulture, great blue heron, and great egret).

Wildlife of the two sites generally is similar. Herpetofauna and avifauna observed during a 1979-1980 survey varied somewhat but the numbers of species were equivalent. Fewer mammal species were observed on the Breckinridge site, however, probably reflecting absence of mature hardwoods habitat similar to that on the Hancock site.

The presence of a greater number of rare (in Kentucky) species on the Hancock site also reflects the difference in nature and condition of habitats on the two sites. The black vulture, although observed flying over both sites, was observed in greater numbers on the Hancock site and was observed roosting on Jeffry Cliff as well. The marsh hawk, which is a migrant and winter resident in the area and utilizes mostly open areas, may be an important seasonal predator on both sites. However, the habitat mosaic (farmland interspersed with hardwoods and streams) on the Hancock site probably is more attractive to the

Table 3.3-4. Checklist of Wildlife Species, Hancock Site, 1979-1980

Amphibians and Reptiles

Dusky Salamander
Long-tailed Salamander
Red-spotted Newt
American Toad
Fowler's Toad
Blanchards Cricket Frog
Spring Peeper
Gray Treefrog
Green Frog
Leopard Frog
Bullfrog
Pickerel Frog
Eastern Box Turtle
Painted Turtle
Fence Lizard
Five-lined Skink
Broad-headed Skink
Black Racer
Eastern Garter Snake
Rat Snake

Birds

Great Blue Heron
Great Egret
Green Heron
Black Vulture
Red-tailed Hawk
Marsh Hawk
American Kestrel
Bobwhite
American Coot
Killdeer
Common Snipe
Spotted Sandpiper
Least Sandpiper
Rock Dove
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Chimney Swift
Ruby-throated Hummingbird
Common Flicker
Pileated Woodpecker
Red-bellied Woodpecker
Red-headed Woodpecker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great-crested Flycatcher
Eastern Phoebe
Acadian Flycatcher
Barn Swallow
Tree Swallow
Purple Martin
Blue Jay
Common Crow
Carolina Chickadee
Tufted Titmouse
White-brested Nuthatch
House Wren
Carolina Wren
Mockingbird
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Hermit Thrush

Birds (Contd)

Eastern Bluebird
Blue-gray Gnatcatcher
Cedar Waxwing
Starling
White-eyed Vireo
Solitary Vireo
Red-eyed Vireo
Warbling Vireo
Black-and-white Warbler
Prothonotary Warbler
Worm-eating Warbler
Tennessee Warbler
Northern Parula
Black-throated Blue Warbler
Yellow-rumped Warbler
Pine Warbler
Louisiana Waterthrush
Kentucky Warbler
Chestnut-sided Warbler
Blackburnian Warbler
Common Yellowthroat
Yellow-brested Chat
Canada Warbler
American Redstart
House Sparrow
Eastern Meadowlark
Red-winged Blackbird
Orchard Oriole
Brewer's Blackbird
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Cardinal
Indigo Bunting
American Goldfinch
Rufous-sided Towhee
Savannah Sparrow
Field Sparrow
Song Sparrow
Tree Sparrow
Chipping Sparrow
White-crowned Sparrow
White-throated Sparrow

Mammals

Opossum
Short-tailed Shrew
Eastern Mole
Evening Bat
Eastern Cottontail Rabbit
Eastern Chipmunk
Woodchuck
Gray Squirrel
Fox Squirrel
White-footed Mouse
Meadow Vole
Pine Vole
Muskrat
House Mouse
Red Fox
Gray Fox
Raccoon
Long-tailed Weasel
Mink
Striped Skunk
White-tailed Deer

Source: Texas Instruments Incorporated field data (1979-1980).

References: American Ornithologists Union (1957) and periodic updates.
Conant (1958).
Robbins et al. (1966).
Burt and Grossenheider (1976).

Table 3.3-5. Checklist of Wildlife Species, Breckinridge Site, 1979-1980

Amphibians and Reptiles

- Red-spotted Newt
- American Toad
- Fowler's Toad
- Blanchards Cricket Frog
- Spring Peeper
- Gray Treefrog
- Green Frog
- Leopard Frog
- Bullfrog
- Pickerel Frog
- Snapping Turtle
- Stinkpot
- Eastern Box Turtle
- Painted Turtle
- Fence Lizard
- Five-lined Skink
- Broad-headed Skink
- Black Racer
- Eastern Garter Snake
- Rat Snake

Birds

- Great Blue Heron
- Great Egret
- Green Heron
- Mallard
- Wood Duck
- Black Vulture
- Broad-winged Hawk
- Merlin
- American Kestrel
- Bobwhite
- American Coot
- Killdeer
- Spotted Sandpiper
- Rock Dove
- Mourning Dove
- Yellow-billed Cuckoo
- Black-billed Cuckoo
- Screech Owl
- Chimney Swift
- Ruby-throated Hummingbird
- Common Flicker
- Pileated Woodpecker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Hairy Woodpecker
- Downy Woodpecker
- Eastern Kingbird
- Great-crested Flycatcher
- Least Flycatcher
- Eastern Phoebe
- Acadian Flycatcher
- Barn Swallow
- Tree Swallow
- Purple Martin
- Blue Jay
- Common Crow
- Carolina Chickadee
- Tufted Titmouse
- White-brested Nuthatch
- House Wren
- Carolina Wren

Birds (Contd)

- Mockingbird
- Gray Catbird
- Brown Thrasher
- American Robin
- Wood Thrush
- Hermit Thrush
- Eastern Bluebird
- Blue-gray Gnatcatcher
- Logerhead Shrike
- Starling
- White-eyed Vireo
- Solitary Vireo
- Red-eyed Vireo
- Warbling Vireo
- Black-and-white Warbler
- Prothonotary Warbler
- Worm-eating Warbler
- Tennessee Warbler
- Prairie Warbler
- Hooded Warbler
- Yellow-rumped Warbler
- Pine Warbler
- Northern Waterthrush
- Kentucky Warbler
- Common Yellowthroat
- Yellow-brested Chat
- Canada Warbler
- House Sparrow
- Eastern Meadowlark
- Red-winged Blackbird
- Orchard Oriole
- Brewer's Blackbird
- Common Grackle
- Brown-headed Cowbird
- Scarlet Tanager
- Cardinal
- Indigo Bunting
- American Goldfinch
- Rufous-sided Towhee
- Savannah Sparrow
- Field Sparrow
- Song Sparrow
- Tree Sparrow
- Chipping Sparrow
- White-crowned Sparrow
- White-throated Sparrow

Mammals

- Opossum
- Short-tailed Shrew
- Eastern Mole
- Eastern Cottontail Rabbit
- Eastern Chipmunk
- Woodchuck
- Gray Squirrel
- Fox Squirrel
- White-footed Mouse
- Red Fox
- Gray Fox
- Raccoon
- Mink
- Striped Skunk
- White-tailed Deer

Source: Texas Instruments Incorporated field data (1979-1980).

References: American Ornithologists Union (1957) and periodic updates.
Conant (1958).
Robbins et al. (1966).
Burt and Grossenheider (1976).

black vulture and other predators that hunt in open areas but roost and nest in hardwoods. Habitat for the evening bat on the Hancock site is the Jeffry Cliff area; observations of this species during 3 seasons indicate it is a resident of the cliff area.

Impacts. Habitat degradation associated with noise, dust, traffic, and other elements of human activity, as well as habitat loss associated with forest clearing or other land use change will impact wildlife of the project area (Table 3.3-6). The decline in wildlife diversity that generally accompanies habitat degradation and habitat loss will be preceded by mortality of numerous individuals during land clearing activities. Some populations will recover, but these generally will be widespread, common species. These impacts will begin during construction of the plant and will continue throughout the life of the plant as landfill areas are worked. Probable continued industrial use of the site beyond the life of the generating station will maintain the life support value of the land at a diminished level, reducing its long-term biological productivity.

Table 3.3-6. Land Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 1 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	Environmental Consequences Breckinridge Site Alternative	Duration/Significance
Geology	Grading and compaction of surface areas for facilities development and construction of barge unloading facilities.	Mechanically strengthen alluvial deposits.	Same.	Permanent beneficial effect for long-term industrial use of the site.
	Deposition of solid waste in landfills.	Increased surface loadings on subsurface geologic formations.	Same.	Permanent but minimal geologic impacts.
	Filling of ravines and benching.	Alter existing topography.	Same.	Permanently change surface runoff patterns and relief.
Soils	Onsite grading operations, compaction, and erosion.	Loss of topsoil, mixing of topsoil and subsoil, reduction of biological productivity.	Same.	Essentially irreversible disruption of soil profile and loss of fertility.
		Elimination of approximately 1050 acres of known and possible prime farmland soils. Disturbance of an additional 1300 acres of non-prime farmland soils.	Elimination of approximately 1125 acres of known and possible prime farmland soils. Disturbance of 850 acres of non-prime farmland soils. Disturbance of 500 acres of unidentified soil types (mostly in upland locations not likely to be prime farmland).	Permanent loss of prime farmland and deep, fertile, well-developed soils necessary for certain existing plant communities. Extensive alteration of pasture and woodland soils. Soils generally are more fertile on Hancock site because of less severe disturbance.
	Leaching and seepage from solid waste landfills, holding ponds, and coal and limestone storage areas.	Whatever leaching may occur will have a high probability of infiltration due to soils characteristics of the disposal sites (i.e., direct deposition of wastes on loamy soils in a region of high rainfall and shallow water tables). Most soils in areas of storage piles are fairly acidic (pH 4.5-6.0) and sensitive to alkaline leachate.	Incompleteness of soil survey for Breckinridge County prevents evaluation of soil characteristics on Breckinridge site. Most identified soils are silt loams similar to those on the Hancock site.	Although disposal of dry solid waste should result in low to moderate probability of contamination, soils on the Hancock site are highly susceptible to leaching. Soil properties on the Breckinridge site, while expected to be similar to the Hancock site, are unknown at this time. Impact of increased trace element concentrations on soils depends on present levels.

Table 3.3-6. Land Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 2 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Soils (Cont.)	Construction of Ponds A, B, and C.	Present location of ponds is on Belknap soils, which may have bedrock as shallow as 7 feet.	Unknown - soils characteristics not available.	Possible difficulty in pond construction now planned for 12.5-foot depth.
	Construction of towers and access roads along corridors.	Disruption of soil profiles, loss of topsoil, mixing of topsoil and subsoil, and compaction. Possibility for major soil loss from local erosion along steeper slopes of the right-of-way.	Similar soil disturbance although less hilly topography and greater extent of existing access roads should reduce erosion and amount of land affected by road construction.	Greatest soil impacts will be on Unit 1 corridor since Unit 2 has existing access roads and topography has less relief. Potential for erosion greater on the Hancock site.
	Clearing woodland vegetation.	Nutrient loss through erosion due to uprooting of vegetation. More extensive woodlands increase erosion potential.	Similar impact on wooded areas but smaller erosion potential due to less extensive woodlands.	Permanent soil loss in some areas. Greater impact on Hancock corridor.
Vegetation				
Cover Types:				
Lowland hardwood forests	Site clearing and grading during construction; drainage alteration during operation.	Loss of approximately 180 acres of lowland forests. (8% of onsite land cover.)	Loss-of approximately 58 acres of lowland forests. (2% of onsite land cover.)	Long-term loss of diminishing cover type in the region.
Upland hardwood forests	Site clearing and filling of ravines with solid waste during operation.	Loss of approximately 475 acres of upland forests. (20% of onsite land cover.)	Loss of approximately 901 acres of upland forests. (36% of onsite land cover.)	Long-term loss of most existing upland associations. Successional shift from climax stage woodlands to pioneer stage old fields following reclamation.
	Soil and moisture disturbance.	Elimination of the mixed mesophytic community.	No comparable effect.	Permanent loss of a regionally uncommon vegetation association.
	Clearing of corridors during construction; maintenance with herbicides during operation.	Loss of approximately 293 acres of woodlands (predominantly upland hardwoods). (39% of corridor land cover.)	Loss of approximately 287 acres of woodlands (predominantly upland hardwoods). (36% of corridor land cover.)	Long-term loss of existing woodland associations. Shift to pioneer stage species. Peripheral vegetation stress

Table 3.3-6. Land Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 3 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Upland hardwood forests (Cont.)				from herbicide spraying.
Wetlands	Site clearing and grading.	Loss of approximately 4 acres of broad-leaved, deciduous, scrub-shrub wetland.	No comparable effect.	Permanent elimination of an ecologically sensitive and regionally limited cover type.
Cropland and pasture	Site clearing, grading construction of facilities.	Loss of approximately 1509 acres of vegetation. (65% of onsite land cover.)	Loss of approximately 1430 acres of vegetation. (58% of onsite land cover.)	Essentially irreversible loss of productive cropland due to extensive soil disturbance.
	Construction of transmission lines.	Affects approximately 461 acres of agricultural land. (61% of corridor land cover.)	Affects approximately 510 acres of agricultural land. (64% of corridor land cover.)	Temporary productivity loss during construction. Essentially permanent cropland loss due to soil disturbance at tower locations. Negligible impact.
Old fields	Site clearing and grading.	Loss of approximately 105 acres of vegetation (5% of onsite land cover).	Loss of approximately 52 acres of vegetation (2% of onsite land cover).	Increased extent of old field cover type following reclamation of land fill areas.
Coniferous forests	Site clearing and grading.	Loss of approximately 7 acres of vegetation (less than 1% of onsite land cover).	No comparable effect.	Minor impact due to limited extent of this cover type. It should be able to re-establish at the end of the 35-year life of the station.
General Vegetation Productivity	Atmospheric emissions during operation, including SO_2, NO_2, particulates, and salt drift. (See Air quality).	Possible acute damage to SO_2 sensitive species. Potential for chronic or latent SO_2 damage to vegetation. Possible damage to onsite vegetation from salt deposition. No anticipated major offsite damage from NO_2, particulates, and salt drift.	Same.	Potential for moderate impact on sensitive vegetation onsite from SO_2, particulate deposition salt drift, and synergistic effects of NO_2 and SO_2. Latent and chronic effects may continue after station retirement. Due to higher ambient levels, likelihood of injury is greater on the Hancock site. SO_2 damage possible offsite.
	Filling of ravines with solid wastes and stockpiling limestone and	Potential build-up of trace elements in vegetation due to leaching and increased	Same.	Long-term gradual increase in trace element concentrations. Impact will depend on existing

Table 3.3-6. Land Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 4 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
General Vegetation Productivity (Cont.)	coal.	concentrations in soils.		concentrations in soils.
	Vegetation removal and burning of slash and unmerchantable timber.	Organic and inorganic nutrient loss.	Same.	Long-term reduction of natural productivity.
	Aerial herbicide spraying along corridors.	Probable injury to sensitive species adjacent to corridor.	Same.	Probable injury to non-target areas from herbicide drift throughout the 35-year maintenance of the corridors.
Wildlife	Site clearing and filing ravines with solid wastes from plant operation.	Loss of approximately 2300 acres of wildlife habitat that has greater landscape diversity and heterogeneity within cover types than the Breckinridge site (e.g., 3 times more lowland hardwoods; twice the extent of old fields and fallow fields; a wetland; and, although less extensive, more diverse upland hardwoods).	Loss of approximately 2400 acres of wildlife habitat that, although more extensive, is less diverse and structurally more homogeneous.	Significant impact to uncommon species due to permanent loss of most of these wildlife habitats and decline of wildlife diversity. Probable continued industrial use of the site will maintain life support value of the land at a diminished level, reducing long-term biological productivity.
		Reduction of wildlife population on and adjacent to the site.	Same.	Habitat degradation and loss will permanently reduce those populations dependent on aquatic and forested habitats and increase species adapted to fallow field vegetation and open, shrub habitats.
		Greater impact on salamanders, lizards, birds of prey, migrant perching birds, nongame mammals, and furbearers. Also greater impact on evening bat and black vulture on the Kentucky Nature Preserves Commission Animal Element List.	Greater impact on turtles, wading and shore birds, waterfowl, and white-tailed deer. Also greater impact on the great blue heron and the great egret on the KNPC Animal Element List.	
		Emigration of mobile wildlife from site into adjacent areas. Limited opportunity for ground-level emigration from site due to Ohio River,	Emigration of deer and other large mammals easier due to lack of barriers along the southern boundary (although this would be blocked by	Eventual population decline probable due to continued habitat loss and increased competition.

Table 3.3-6. Land Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 5 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	Environmental Consequences Breckinridge Site Alternative	Duration/Significance
Wildlife (Cont.)		adjacent industry, and highways surrounding the site.	proposed synfuel facility development).	
		Mortality of animals with limited mobility (e.g. mammals, reptiles, amphibians).	Same.	Impact during vegetation clearing for facilities construction and landfill activities.
	Higher traffic levels. (coupled with clearing)	Increased road kills along U.S. 60, Ky. 1406, and Skillman Road.	Increased road kills along Ky. 144.	Greatest impact during construction period.
	Vegetation clearing and transmission line construction along corridors.	Increase of birds and mammals associated with fallow field, shrub, and open woodland habitats.	Same.	Creation of edge habitat where corridor crosses woodlands, although expected to increase the number of common bird species, may not support greater diversity than adjacent habitat with greater stratification.
		Use of lines and towers by raptors for hunting perches and possibly nest support structures.	Same.	
		Increased wire strikes from waterfowl and other bird groups.	Same.	Mammals expected to increase along corridor are common species having a broad range of tolerances, high dispersal ability, and high reproductive rates.
		Compared with Breckinridge Unit 1 corridor, more extensive woodlands make impact on forest wildlife greater. Riparian habitats will receive less impact along Unit 1 corridor and more impact along Unit 2 corridor than on comparable Breckinridge corridors.		Although greatest displacement will occur during construction, maintenance practices will continue impact throughout life of the generating station. Overall impact greater with Hancock alternative.

3.4 WATER

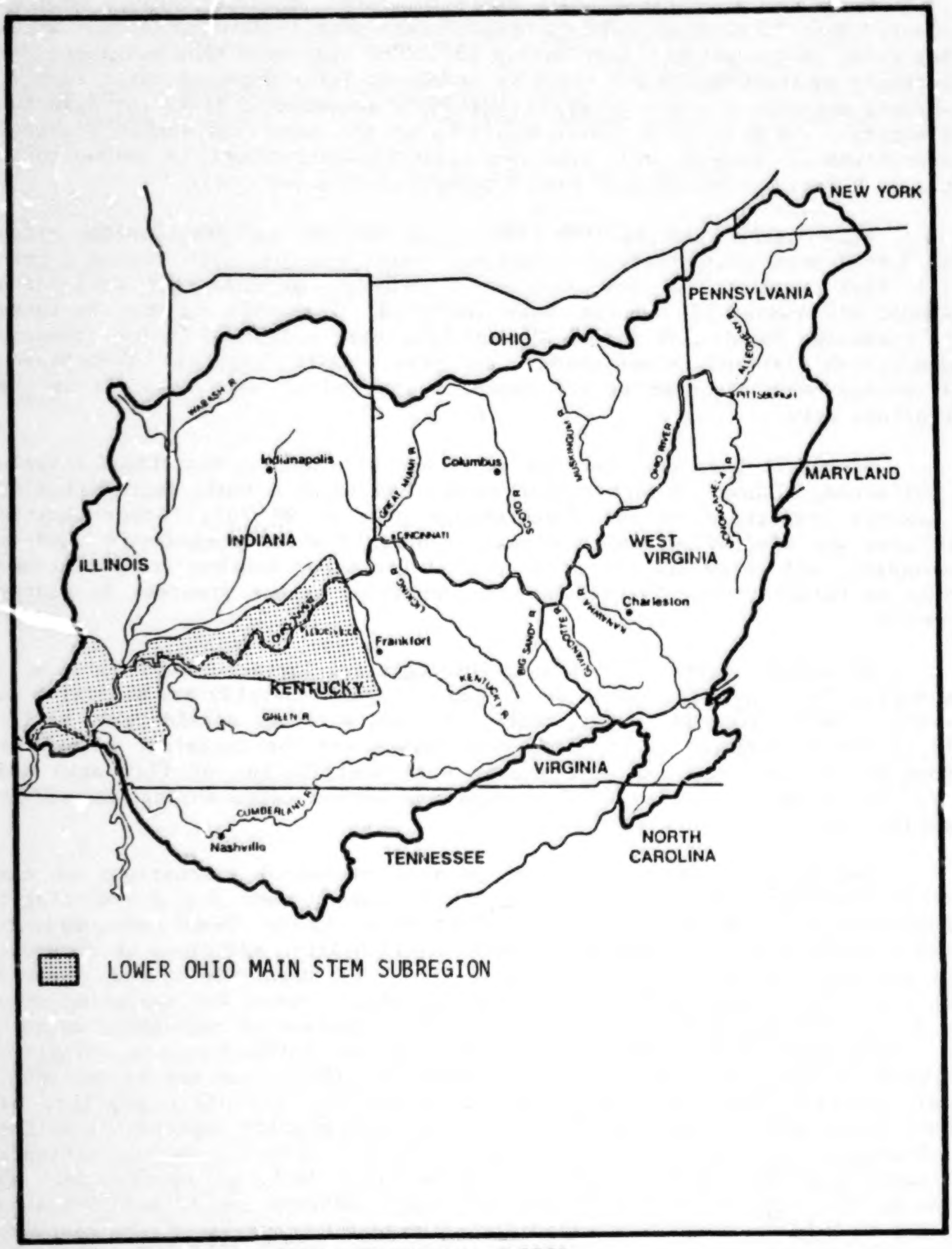
3.4.1 Ohio River

Baseline. The Hancock (RM 715) and Breckinridge (RM 705) sites are in the Lower Ohio Main Stem subregion of the Ohio River Basin, which consists of 12,570 square miles within the last 435 miles of the river (Figure 3.4-1). They are in the Cannelton Pool, created by the McAlpine Lock and Dam at RM 606.8 and Cannelton Lock and Dam at RM 720.7. Normal elevation of the pool is 382.3 feet msl, assuring a 9-foot deep navigation channel during low-flow periods. Existing 7-day, 10-year (7Q10) (week-long low flow with an expected natural recurrence in a 10-year period) is 12,975 cubic feet per second (cfs). This is double the natural low flow prior to establishment of the present system of reservoirs in the watershed and less than that expected when planned reservoirs are completed (14,200 cfs). Average flow of the river in the project area is 151,417 cfs, based on 3 years data from the Ohio River Valley Water Sanitation Commission (ORSANCO) monitoring station at Cannelton Dam.

The Ohio River Basin Commission (ORBC) projects an ample supply of water for various consumptive uses (municipal, industry, and agriculture) and instream uses (recreation, fish, and wildlife) through 2020, but believes the anticipated consumption at that time may reduce the low flow below that needed to maintain water quality (14,300 cfs). Water quality problems would indirectly affect instream uses. By 2020, the ORBC believes that power plants will be a larger consumer than all others combined. Future power plant usage probably will be higher than believed because when the projection was made, once-through cooling was still a preferred alternative for a portion of future use. ORBC believes projections for municipal and industrial use other than power plants or synfuel plants are too high because regional growth has slowed. However, based on 1980 Kentucky Department of Energy predictions of synfuel development in Kentucky, synfuel industry projections may be too low and could, along with possible greater power plant consumption, offset the high projections for municipal and other industry consumptive uses.

Among the mitigative measures suggested by ORBC for maintaining water quality critical flow are use of once-through cooling and adoption of low-flow policies by all Basin states similar to those of Indiana and Pennsylvania, which require consumers to develop reservoir storage to meet their demands during droughts. The first alternative appears to be unfavorable to permitting and approving agencies, but efforts to reduce the effects of increased consumption on low flow via new reservoirs appear successful. The dam and reservoir system also serves to reduce flood elevations 2 to 3 feet for the 100-year flood level. Other ORBC plans for maintaining water quality are development of water and energy conservation programs and stricter requirements for wastewater treatment to reduce pollutant discharge.

Dissolved oxygen depletion is ORBC's main concern relative to water quality critical flow. At present the ORBC includes barium, cadmium, chloride, chromium, copper, iron, manganese, phosphorous, selenium, silver, and zinc among the inorganic chemicals that cause no major water quality problem, although some of these appear to be above drinking water or aquatic life standards in the project area (see Table 2.1-20). Cyanide and mercury are considered problems in the Upper Ohio, and lead is considered a problem in the Upper and Middle


NEW YORK
PENNSYLVANIA
OHIO
ALLEGHENY R.
PITTSBURGH
OHIO RIVER
MUSKINGUM R.
MONONGAHELA R.
MARYLAND
WEST VIRGINIA
Charleston
KANAWHA R.
GUYANDOTTE R.
BIG SANDY R.
SCIOTO R.
Columbus
GREAT MIAMI R.
CINCINNATI
WABASH R.
Indianapolis
INDIANA
ILLINOIS
LICKING R.
Frankfort
KENTUCKY R.
KENTUCKY
GREEN R.
VIRGINIA
CUMBERLAND R.
Nashville
TENNESSEE
NORTH CAROLINA
LOWER OHIO MAIN STEM SUBREGION

SOURCE: Ohio River Basin Commission (1978)

Figure 3.4-1. Ohio River Basin

Ohio. Limited organic chemical data indicate phenol problems through much of the river. This is substantiated by ORSANCO data used to develop Table 2.1-20. Samples taken in the project area during 1979-1980 indicated that manganese may consistently exceed ORSANCO and Kentucky standards for a drinking water supply, and mercury was near or somewhat above Kentucky's recommended limit for drinking water supply. Further, fish tissue analysis at the same time showed elevated concentrations of arsenic and selenium (insufficiently high to cause toxic effects on humans consuming less than 2 pounds of fish per day).

Fish observed during 1979-1980 at the Hancock and Breckinridge sites (Table 3.4-1) were predominantly forage and rough species, with game and commercial fish sampled in low numbers. Although no Federally designated threatened or endangered species were observed, 3 species on the Kentucky Nature Preserves Commission Animal Element List were collected in low numbers: The paddlefish (larvae), river shiner, and pirate perch (adults). Twenty-nine total species were observed at the Hancock site and 31 were observed at the Breckinridge site.

No mussel beds were located at either site and no individual mussels were collected, although a more recent survey has found a small aggregation of live mussels downstream of the Breckinridge site at RM 707. Other benthic communities are similar at the 2 sites: tubificid worms predominate, midges are abundant, and these and virtually all of the other benthos are pollution-tolerant or facultative. Overall benthic densities appear greatest in winter and spring.

Planktonic animals (including fish eggs and larvae) appear to be most dense during June and early July. Densities and taxa generally are similar from nearshore to mid-river and from surface to bottom, although considerable variability is not uncommon. Their planktonic nature and the turbulent nature of the Ohio River seem to produce a rather even distribution of fish eggs and larvae. The greatest density of fish eggs and larvae taken during the survey was during June at RM 715 (Figure 3.4-2).

Impacts. In addition to the navigation hazard evaluations of the two sites (extreme impact for Hancock, significant impact for Breckinridge; see Subsection 2.1.4.4 and Table 3.4-4), impacts to the Ohio River from project-related activities will be demands on water availability, additions of chemical wastes and heat, and disruption of aquatic life. The magnitude of such impacts to water systems generally is limited through plant design and operating procedures that intend compliance with policy and guidelines of regulatory authorities. Consistent with currently adequate regional water supplies, explicit controls on water demand through water rights or allocations are nonexistent. However, indirect ones are related to water quality controls and policy of the Ohio River Basin Commission (created along with similar Commissions by the Water Resources Planning Act of 1965 (PL 89-80)). Controls on the nation's water quality are provided for by the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.), Safe Drinking Water Act of 1974 (PL 93-523, as amended), and Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S.C. 3251 et seq.). Pursuant to these Acts, this project must comply with Kentucky Water Quality Standards (401 KAR 5:026, 029, 031, and 035), EPA's effluent guidelines and standards for steam electric power generation (40 CFR 423), and standards of the Ohio River Valley Water Sanitation Commission.

Table 3.4-1

Table 3.4-1. Fish Collected at the Cannelton Lock and Dam (RM 721) 1968-1970 and 1975-1976, and from the Project Area (RM 702-722), 1979-1980

Common Name	Scientific Name	Time Span*
Paddlefish	*Polyodon spathula*	X, 0**
Longnose gar	*Lepisosteus osseus*	X, 0
Bowfin	*Amia calva*	X
American eel	*Anguilla rostrata*	X
Skipjack herring	*Alosa chrysochioris*	X, 0
Gizzard shad	*Dorosoma cepedianum*	X, 0
Threadfin shad	*Dorosoma petenense*	X
Goldeye	*Hiodon alosoides*	X, 0
Mooneye	*Hiodon terigsus*	X, 0
Goldfish	*Carassius auratus*	X, 0
Carp	*Cyprinus carpio*	X, 0
Stoneroller	*Campostoma anomalum*	0
Silver chub	*Hybopsis storeriana*	X
Golden shiner	*Notemigonus crysoleucas*	X, 0
Emerald shiner	*Notropis atherinoides*	X, 0
River shiner	*Notropis blennius*	X, 0**
Mimic shiner	*Nortopis volucellus*	0
River carpsucker	*Carpiodes carpio*	X
Quillback	*Carpiodes cyprinus*	X
Highfin carpsucker	*Carpiodes velifer*	X
Bullhead minnow	*Pimephales vigilax*	0
Smallmouth buffalo	*Ictiobus bubalus*	X
Bigmouth buffalo	*Ictiobus cyprinellus*	X
Spotted sucker	*Minytrema melanops*	X
Golden redhorse	*Moxostoma erythrurum*	X, 0
Blue catfish	*Ictalurus furcatus*	X
Black bullhead	*Ictalurus melas*	X
Yellow bullhead	*Ictalurus natalis*	X
Brown bullhead	*Ictalurus nebulosus*	X
Channel catfish	*Ictalurus punctatus*	X, 0
Flathead catfish	*Pylodictis olivaris*	X, 0
Pirate perch	*Aphredoderus sayanus*	X**,***
White bass	*Morone chrysops*	X, 0
Striped bass	*Morone saxatilis*	X
Green sunfish	*Lepomis cyanellus*	X, 0
Pumpkinseed	*Lepomis gibbosus*	0
Warmouth	*Lepomis gulosus*	X, 0
Bluegill	*Lepomis macrochirus*	X, 0
Longear sunfish	*Lepomis megalotis*	X, 0
Redear sunfish	*Lepomis microlophus*	X
Smallmouth bass	*Micropterus dolomieui*	X, 0
Spotted bass	*Micropterus punctulatus*	X
Largemouth bass	*Micropterus salmoides*	X, 0
White crappie	*Pomoxis annularis*	X, 0
Black crappie	*Pomoxis nigromaculatus*	X, 0
Johnny darter	*Etheostoma nigrum*	0
Log perch	*Percina caprodes*	0
Sauger	*Stizostedion canadense*	X, 0
Walleye	*Stizostedion vitreum*	X, 0
Freshwater drum	*Aplodinotus grunniens*	X, 0

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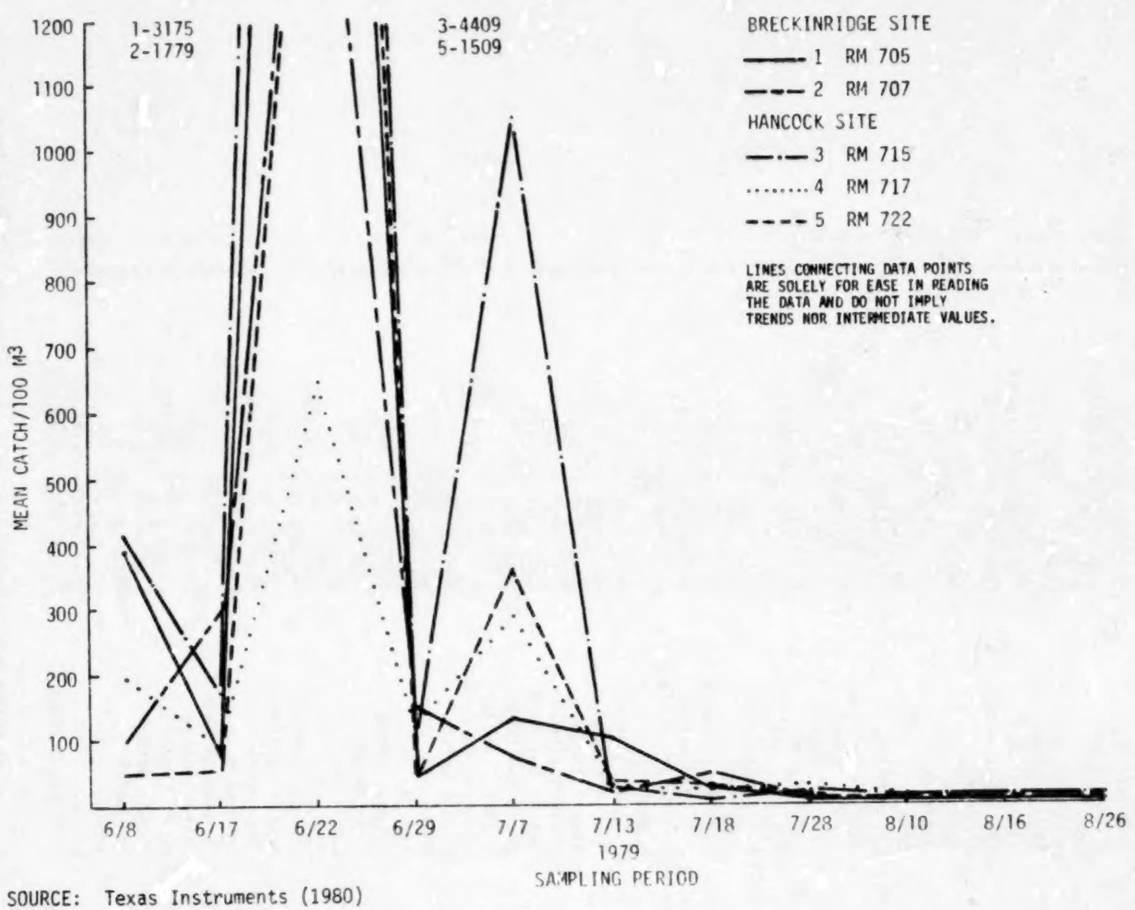
*X – collected during 1968-1970, 1975-1976 (Preston and White 1978).
0 – collected during 1979-1980 (Texas Instruments Incorporated).

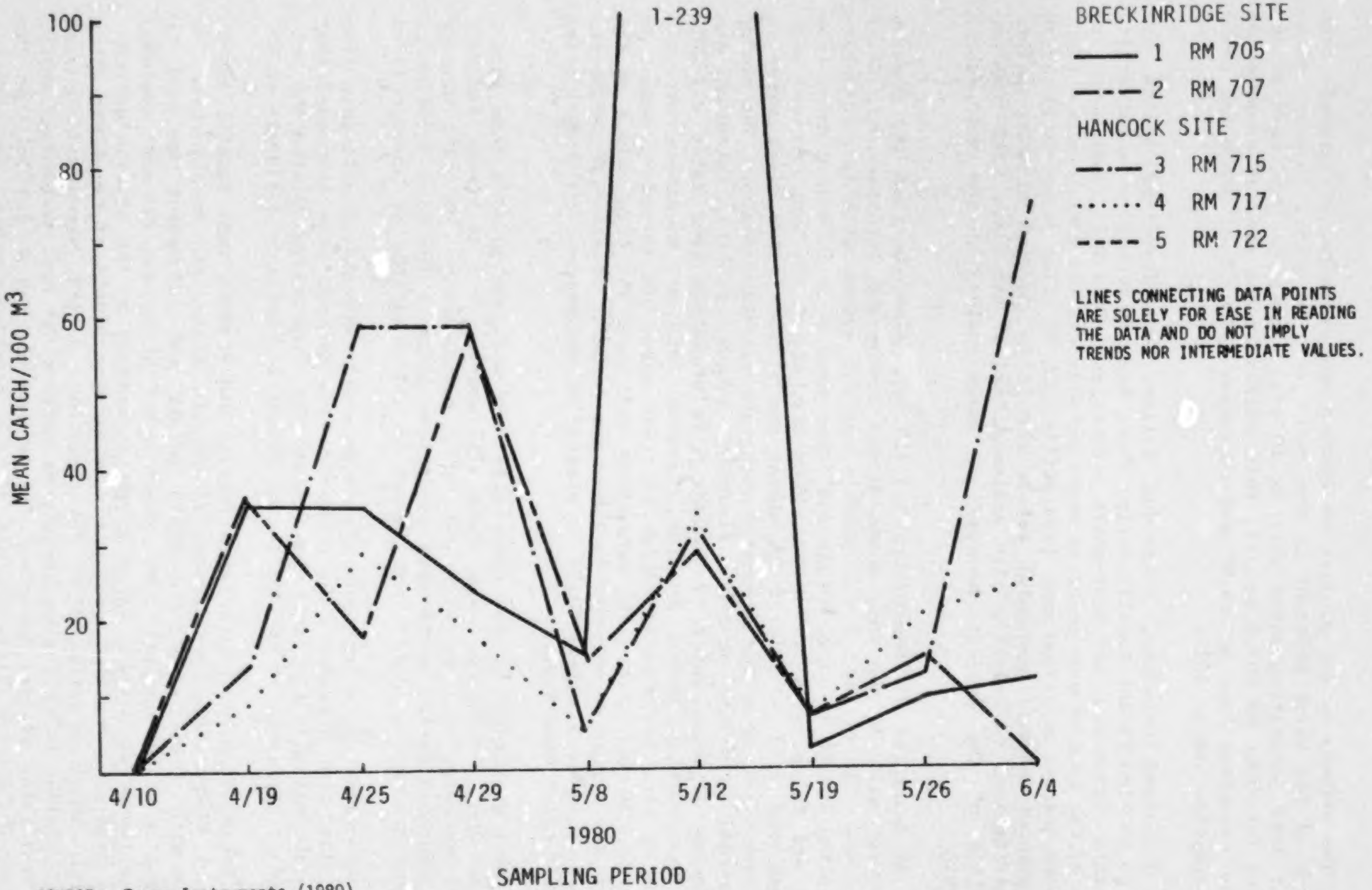
**Included in the Kentucky Nature Preserves Commission Animal and Plant Element List.

***Collected during 1979-1980 from on-site streams.



SOURCE: Texas Instruments (1980)

Figure 3.4-2. Mean Numbers (per $100 m^3$) of Fish Eggs and Larvae, Ohio River Miles 705, 707, 715, 717, and 722, 1979-1980 (Sheet 1 of 2)



LINES CONNECTING DATA POINTS ARE SOLELY FOR EASE IN READING THE DATA AND DO NOT IMPLY TRENDS NOR INTERMEDIATE VALUES.

SOURCE: Texas Instruments (1980)

Figure 3.4-2. Mean Numbers (per 100m^3) of Fish Eggs and Larvae, Ohio River Miles 705, 707, 715, 717, and 722, 1979-1980 (Sheet 2 of 2)

The effects of the project on current and projected withdrawals from the stretch of the river adjacent to the sites will be minor. Average withdrawal for both generating units will be 19 cfs. Based on ORBC records and projections for Ohio RM 605.8 to 784, this will increase present consumptive use of the Cannelton Pool by 26.8% and represent only 3% of projected power plant consumptive use in 2020.

Increased turbidity, suspended solids, and dissolved solids are expected to be significant locally during three 8-month periods of constructing docks, intake structures, and near-shore structures. This will cause temporary avoidance of the area by some instream users and will disturb bottom communities. However, the nearest municipal user (Evansville, IN, 70 miles downstream) should not be impacted because suspended solids should be reduced at that point. Minor contributions to existing high sediment load of the river will continue for the life of the project because of barge unloading and maintenance activities.

As described in Subsection 2.1.4.3.5.3, blowdown from the plant's cooling towers will be the only waste stream discharged into the Ohio River (Table 3.4-4). The effect of the plant's cooling system will be to concentrate existing levels of heavy metals and other substances in makeup water from the river and raise its temperature. When discharged, the concentrated substances and heat will be diluted by mixing the effluent with river water in a mixing zone effected by the discharge structure operating design. The mixing zone is needed to dilute arsenic, fluoride, barium, sulfate, selenium, and chloride below drinking water or aquatic life standards (see Table 2.1-20). Iron, mercury, cadmium, phenol, cyanide, chromium, lead, and manganese currently exceed one or more Kentucky standards in river water and therefore cannot be diluted with a mixing zone. All parameters will meet 44% LC_{50} values at the point where the discharge velocity is 2 feet per second. Dilution of parameters above drinking water standards will be assured at the nearest withdrawal point more than 70 miles downriver.

Heat discharged to the river will vary with the plant's load factor and time of year. Discharge temperature will average 64°F in winter and 82°F in summer; maximums will be 69°F and 96°F, respectively. The 2°F surface isotherm occurring during worst-case conditions after a 100 to 1 dilution is not expected to have a significant impact on water quality or aquatic life.

An evaluation of the potential synergistic effects of effluents from the power plant and Willamette Industries at the Hancock site concluded that distance would minimize the limited potential for interaction between the primarily organic effluents of Willamette and primarily inorganic effluents of KU.

Intake of makeup water will impinge and entrain some aquatic organisms, mainly fish eggs, fish larvae, planktonic algae, and zooplankton. In conjunction with issuance of the NPDES permit and subsequent approval to begin operation of the proposed power plant under the permit, EPA must evaluate the adverse impact of cooling water intake structures on the aquatic environment. The provision for this evaluation is Section 316(b) of the Clean Water Act of 1977, which requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse impacts. EPA tentatively has determined that the requirements of Section 316b are met by the proposed intake. Alternative intake systems were discussed in Subsection 2.1.4.3.4.1.

Location. Proposed locations of the intake structures are RM 716 at the Hancock site and RM 705.5 at the Breckinridge site. The two intake pipes will extend into the river 340 and 640 feet, respectively. Depth of the intake screens will be 22 feet. One year's data on aquatic populations were collected upstream and downstream of intake positions at both sites. At the Hancock site, one year's data showed greater numbers of fish, fish eggs and larvae, and macrozooplankton were collected at RM 715 upstream from RM 716; at the Breckinridge site, greater numbers of the same groups were collected from RM 705 than from RM 707. Distribution data for fish eggs and larvae at both sites showed no consistent trends across the river nor with depth. Species composition of each group of organisms was similar at all sampling locations, with commercial, game, and rare fish in low numbers. Threatened or endangered species are not a factor, although declined mussel populations are. No significant mussel beds were found at any sampling location so there should be no impact on these bottom fauna.

Location of the intake and discharge structures at RM 716 at the Hancock site and RM 705.5 at the Breckinridge site shortens length of the piping to the cooling towers to the extent possible. At the Hancock site, the discharge pipe extends 38 feet into the river at a depth of 6 feet and is somewhat downstream of the intake structures. These distances between intake structure and the discharge outfall should be sufficient to preclude recirculation of the discharge water and impingement and entrainment of aquatic life that may aggregate in the thermal plume of the outfall. Depth of the intake structures will be more than twice the 9-foot channel depth maintained by the COE.

Design. Designs of the intake structures and discharge structure should meet guidelines that provide for environmental and cost considerations. As discussed in Subsection 2.1.4.3.4.1, construction, maintenance, entrainment, impingement, and cost were considerations in the selection of intake structures. The offshore stationary slotted screen intake structures that are proposed will have intake velocities of 0.5 feet per second or less, as suggested by EPA. They will be oriented and shaped such that resistance to natural water flow is minimal. They are expected to be self-cleaning and to have less impingement and entrainment effects than onshore traveling screens. The intake pumps will be housed on the shoreline, so that their motors will be above design high water level.

Construction. Construction specifications of the intake and discharge structures are shown in Figure 2.1-12. Many of the effects of construction on aquatic life were discussed above. As noted, construction impacts overall will be minor and short-term since dredging maintenance is not anticipated. They are expected to be of similar magnitude to those associated with construction of onshore traveling screen systems, which generally require periodic dredging to remove silt build-up in front of the screens.

The construction schedule of April through November (during three successive years) would have less impact on fish populations if dredging were omitted when fish larvae are most dense.

Capacity. Intake volume is minimized by use of cooling towers and the circulating water system described in Subsection 2.1.4.3.3.1. Since entrainment and impingement of aquatic life also are functions of intake volume, minimal makeup requirements will reflect minimization of impact.

Assuming even distribution of fish eggs and larvae and other planktonic components (as indicated by sampling results), entrainment expected at the plant may be estimated as the percent of river flow represented by makeup flow. Maximum entrainment, estimated as percent of the 7-day, 10-year low flow, would be 0.26% of the river's planktonic populations. Average entrainment for 7Q10 conditions would be 0.15%. Under average river conditions (approximately 150 thousand cfs) and maximum plant load, entrainment would be about 0.02%. This normally would be expected in July and August, when fish eggs and larvae density has declined from the June peak.

The foremost difference in impacts to aquatic biota of the river at the two sites is in entrainment potential. Collection data from five locations on the river showed June and July 1979 fish eggs and larvae density to be highest at RM 715 at the Hancock site and one collection from June 1980 showed the same. Further, except during June when collections at both locations at the Breckinridge site (RM 705 and 707) showed higher densities than the two other locations near the Hancock site (RM 717 and 722), densities were consistently higher at the Hancock site locations. This indicates greater entrainment potential of fish eggs and larvae by an intake at the Hancock site, but no significant impact is anticipated based on the small percentage of entrainment expected by the intake design.

3.4.2 Groundwater

Baseline. The alluvium of the Ohio River floodplain contains the greatest potential source of groundwater in the project area (average 350 gpm per well). Water-bearing sandstones generally produce more than adequate quantities for domestic use (average 100 gpm per well), and limestone aquifers generally produce the least amount (20 gpm per well). Recharge of the alluvial aquifer is predominantly from the river, with the hydraulic connection between the river and aquifer ranging from poor to excellent. Recharge from precipitation is estimated to range from 0.3 to 0.5 mgd per square mile, and leakage from permeable rocks at the valley wall adjacent to sand and gravel deposits yields about 0.2 mgd per square mile.

Groundwater quality in the project area is generally good. Water in the sandstone aquifers is soft to moderately hard but it may contain undesirable amounts of iron. Water from the alluvial aquifer generally is harder and contains more iron than the sandstone aquifers.

Several of the domestic and municipal wells in the project area exhibit higher to much higher iron levels than recommended by EPA for municipal systems (0.3 mg/liter). Wells supplying Cannelton and the Hancock site exhibit high levels of iron as well as levels of nitrates that exceed EPA's 10 mg per liter standard. With the exception of these chemicals, no pollution problems are associated with the project area groundwater. The iron is naturally occurring in the sandstone hemitites. Elevated nitrates may be due to leachates from agricultural fertilizers.

Impacts. Potential impacts to groundwater from the power plant include drawdown of the aquifer, reducing availability, and alteration of water quality or water characteristics such as taste. Pursuant to the Clean Water Act of 1977 and Safe Drinking Act of 1974, the Applicant will monitor groundwater quality to assure no long-term impacts to the potable water. A RCRA permit is not required for the proposed plant operations since wastes associated with fossil fuel power plants are excluded from hazardous waste regulations. The plant's solid wastes are, however, subject to RCRA Subtitle D criteria (state or regional development of environmentally sound methods of solid waste disposal and those that maximize utilization of valuable resources and encourage resource conservation). The status of power plant wastes under RCRA is subject to change pending further study.

Because the major source of groundwater in the project area is the alluvial aquifer and recharge is predominantly from the Ohio River, municipal and industrial groundwater supplies apparently exceed withdrawals and will continue to do so in both counties (Table 3.4-4). Stress, if any, will be greater on supplies in Hancock County, although none is presently identified. Location of high-capacity wells as close to the river as possible, and where hydraulic connection is good, reduces the effects of rapid water withdrawal on those groundwater systems farther inland.

Although river recharge of the alluvial aquifer will preclude impact of constructing foundations and other pavements and compacted areas on the alluvium, recharge of the bedrock aquifers in landfill locations of both sites will be affected by deposition of cementitious waste products. Runoff will be increased and percolation of the predominately silt-loam soils will be decreased. Because the bedrock aquifers contribute little to municipal and industrial groundwater supplies tapped in the project area, groundwater demand is not expected to be significantly affected.

The Applicant has proposed clay liners for holding Ponds A, B, and C. Clay liners are one of four major types of liners: compacted earth liners, chemical sealants, rigid liners, and flexible synthetic liners Of these, only synthetic liners are impermeable. Clay liners usually have lower hydraulic conductivities than liners of other compacted soil types. If naturally occurring clays are not available, montmorillonites, especially bentonites, can be purchased and mixed with the natural soils prior to compacting into a liner. Hydraulic conductivities reported for a clay-soil mixture are 1.8 to 0.6 feet per day. According to the Applicant, clay liners for the Hancock ponds will have permeability of approximately 0.003 feet per day. Unlike rigid liners (e.g., concrete, gunite, asphalt concrete), clay and other compacted earth liners are flexible enough to withstand seismic activity subsurface settlement, and they remain stable in wet and dry conditions. Flexible synthetic liners also generally will withstand these conditions and prevent infiltration as well. However, as indicated, preclusion of leaching in this case probably is not necessary to prevent significant impact. Flexible synthetic liners are vulnerable to puncture (especially during installation), aging with exposure to sun or temperature extremes (generally conditionally guaranteed for 20 years), reaction with ponded wastes, and stresses from trapped gases or groundwater. Chemical sealants, which reduce permeability of the natural soils, are not always effective in their present state of technology.

Soil characteristics in many of the proposed landfill areas on the sites indicate relatively high permeability and potential for infiltration of trace elements and other substances in those areas. The stabilized waste to be deposited on the soils in the landfill areas is lower in both leachability and permeability than sludges, so that impacts to groundwater quality probably will be minimized.

Because few coal-fired power plants use the new stabilized waste treatment system proposed for the Hancock plant, data on potential impact on water quality characteristics are limited. Data from ponded, filtered runoff from a landfill of cementitious sulfites at another power plant site in Kentucky (the Hancock plant will produce a mixture of sulfates and sulfites) indicate that significant increases could occur in hardness and total dissolved solids of groundwater. Existing hardness of groundwater at the Hancock site was not measured but values as high as those recorded from landfill runoff at the other station (very hard category) would be rare in groundwater of the sandstone aquifers, which are the more important of the bedrock aquifers in the project area and proposed landfill locations. Hardness per se has no health or welfare effects but may become a matter of economics should treatment be necessary prior to use. Total dissolved solids may have some welfare and health effects (in susceptible persons) in large quantities. Good tasting water generally contains less than 750 mg TDS/liter, as reported for sandstone aquifers in the project area.

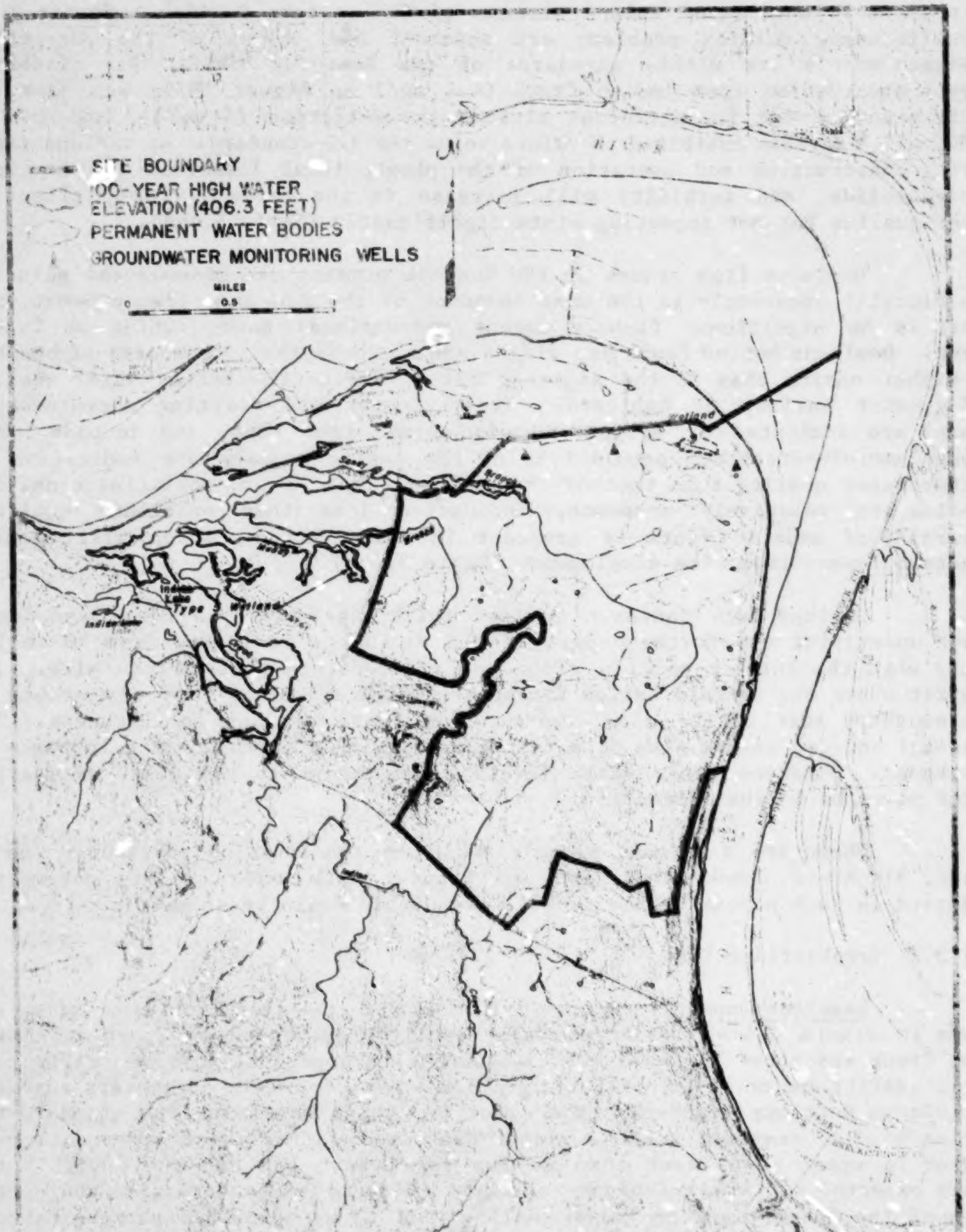
Sulfate and chloride contents of total dissolved solids, which may produce adverse effects in susceptible persons, were above drinking water standards in several samples from the treated runoff. Trace inorganics that often exhibited higher levels than drinking water standards were manganese and iron. As mentioned previously, the effects of excess manganese and iron on human health are basically unknown, although excess iron may affect the taste and use of water and have toxic effects on aquatic life. Manganese and especially iron leachates would contribute to already high levels. Although nitrates were not tested in the runoff and may not be a significant constituent of either that runoff or the Hancock runoff, fertilizer application during revegetation of landfill areas could increase already high levels.

On one occasion, selenium in the treated runoff exceeded drinking water standards. It is unlikely that sufficient selenium would be leached into groundwater to allow the possibility of ingestion of potentially toxic amounts (greater than 0.1 mg per day), although this would depend on ambient levels. It is assumed that groundwater monitoring will detect any impact on ambient concentrations.

3.4.3 Onsite Water Resources

3.4.3.1 Hancock Site

Baseline/Impacts. Water resources of the Hancock site are shown in Figure 3.4-3, and selected water quality parameters of the 3 streams are


SITE BOUNDARY
100-YEAR HIGH WATER ELEVATION (406.3 FEET)
PERMANENT WATER BODIES
GROUNDWATER MONITORING WELLS
MILES
0
0.5
1
RIVER
Wetland
Type 3 Wetland

SOURCE: USGS Topographic Maps
Sargent & Lundy (1980)

Figure 3.4-3. Water Resources, Hancock Site, 1979

shown in Table 3.4-2. Present water quality of the streams is representative of relatively unpolluted upland streams of the eastern deciduous forest. No specific water quality problems are apparent and values of the parameters analyzed mostly are within standards of the Kentucky DNREP. One dissolved oxygen observation from Indian Creek (4.1 mg/l in August 1979) was near the DNREP standard for instantaneous minimum concentration (4 mg/l), and in May 1980, all 3 streams exhibited pH values below the 6.0 standard. At various times during construction and operation of the plant, total dissolved solids, suspended solids, and turbidity will increase in the three streams, affecting water quality but not impacting biota significantly (Table 3.4-4).

Dominant fish groups in the Hancock streams are minnows and shiners. The bluegill apparently is the most abundant of the few game fish present, and there is no significant fishery except recreational bank fishing on Indian Creek. Dominant bottom fauna are midges and oligochaetes. Diversity of benthos is higher onsite than in the adjacent river, reflecting better water quality and greater variety of habitats. Free-swimming and drifting macroinvertebrates are dominated by midges, naidid worms, true bugs, and isopods. Although macroinvertebrate populations of the onsite streams are indicative of better water quality than that of the adjacent Ohio River, pollution-sensitive species are relatively uncommon, indicating less than excellent quality. Diversity of aquatic biota is greatest in Sandy Branch, which will receive greatest impact from site development (Table 3.4-4).

Borings data indicate aquifer thickness above the Glen Dean Limestone underlying the northern part of the Hancock site ranges from 50 to 150 feet, with the thicker portion along the northwestern part of the site. The aquifer above the Buffalo Wallow Limestone, which underlies lower elevations of the southern part of the site, varies from 15 to 40 feet in thickness. The alluvial aquifer at the site dips to the west, with a corresponding increase in thickness. Observed water table levels also decline to the west, indicating water movement in that direction.

There are 3 streams along the Hancock transmission corridor: Indian Creek, Blackford Creek, and Sugarcamp Branch. All water quality parameters observed in each stream (Table 3.4-3) were within Kentucky standards.

3.4.3.2 Breckinridge Site

Baseline/Impacts. Water resources of the Breckinridge site are shown in Figure 3.4-4. Selected water quality parameters of Upper and Lower Town Creek are shown in Table 3.4-2. Town Creek apparently has generally good water quality and no major pollution problems. Values of the parameters analyzed are within Kentucky standards except for pH, which was below the standard (6) during 4 of 7 sampling months. Total dissolved solids levels apparently are higher in upper Town Creek than in the lower part but are still within the range expected for small Kentucky streams. Effects of construction and operation of the power plant on water quality will be as described for the Hancock site, although more significant because of better water quality of upper Town Creek (Table 3.4-4).

Dominant fish groups in Town Creek are minnows and shiners, although bluegill may become quite abundant in the summer. Bank fishing is common on lower Town Creek at the embayment, although game fish generally appear limited

Table 3.4-2. Water Quality of Streams on the Hancock and Breckinridge Sites, 1979-1980

Parameter	Indian Creek							Muddy Branch							Sandy Branch						
	1979			1980				1979			1980				1979			1980			
	Aug	Sep	Dec	Apr	May	Jun	Jul	Aug	Sep	Dec	Apr	May	Jun	Jul	Aug	Sep	Dec	Apr	May	Jun	Jul
HANCOCK SITE																					
Dissolved oxygen (mg/ℓ)	4.1	6.4	7.0	12.4	8.9	8.8	8.5	6.3	6.5	5.6	13.2	9.2	7.2	8.0	8.5	6.3	6.2	13.6	11.2	8.4	8.4
Temperature (°C)	22.2	20.5	5.4	12.7	15.9	20.8	29.2	21.0	21.5	5.4	12.2	16.1	21.2	28.0	21.5	21	5.5	14.2	14.3	16.8	27.8
pH	6.3	6.9	6.0	6.7	5.3	6.5	6.7	6.7	6.9	6.4	6.8	5.5	6.4	6.8	6.0	7.3	6.1	6.4	5.6	6.4	6.6
Total dissolved solids (mg/ℓ)	229	98	173	236	257	247	134	135	85	192	110	128	127	138	159	97	99	165	182	166	151
Total suspended solids (mg/ℓ)	12	50	149	13	15	30	123	5	15	68	17	9	9	14.7	2	24	55	6	6	6	58
Turbidity (NTU)	11	47	68	–*	6	14	38	7	24	44	–*	7	7	65	3	22	36	–*	5	3	34
Biochemical oxygen demand (mg/ℓ) (BOD_5)	1.2	2.3	3.0	1.7	2.2	2.5	4.4	3.8	1.8	2.3	1.1	1.6	1.3	3.5	0.9	2.3	2.1	1.0	1.3	3.0	3.7
Velocity (ft/s)	<0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0	0.9	1.0	1.1	1.3	0.9	1.3	1.0	1.1	1.0	0.8	1.5	1.3	1.6
Conductivity (μmhos)	285	200	310	360	360	340	330	210	210	320	360	360	320	370	210	220	410	400	350	370	390

Parameter	Upper Town Creek							Lower Town Creek						
	1979			1980				1979			1980			
	Aug	Sep	Dec	Apr	May	Jun	Jul	Aug	Sep	Dec	Apr	May	Jun	Jul
BRECKINRIDGE SITE														
Dissolved oxygen (mg/ℓ)	5.9	6.3	6.6	11.2	10.1	7.2	8.9	7.7	6.5	6.6	13.0	9.1	10.8	8.0
Temperature (°C)	21.5	20.0	5.5	11.6	14.1	17.4	27.9	27.5	21.5	5.2	16.2	17.3	20.9	31.0
pH	5.4	7.1	5.1	6.1	5.6	6.3	6.8	5.8	7.2	5.3	5.9	5.7	6.6	7.1
Total dissolved solids (mg/ℓ)	209	262	238	286	303	297	212	211	178	151	225	236	223	137
Total suspended solids (mg/ℓ)	12	4	93	15	12	22	9	67	63	52	46	51	52	54
Turbidity (NTU)	27	22	69	–*	4	12	15	48	43	32	–*	5	43	50
Biochemical oxygen demand (mg/ℓ) (BOD_5)	3.1	2.2	3.3	1.2	1.7	2.2	3.3	4.6	3.0	3.1	4.5	3.9	3.6	4.3
Velocity (ft/s)	1.0	0.5	3.3	1.2	1.5	1.1	1.8	<0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Conductivity (μmhos)	310	240	390	410	380	360	380	295	220	380	380	340	320	360

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*Samples held too long for analysis (delayed in transit).

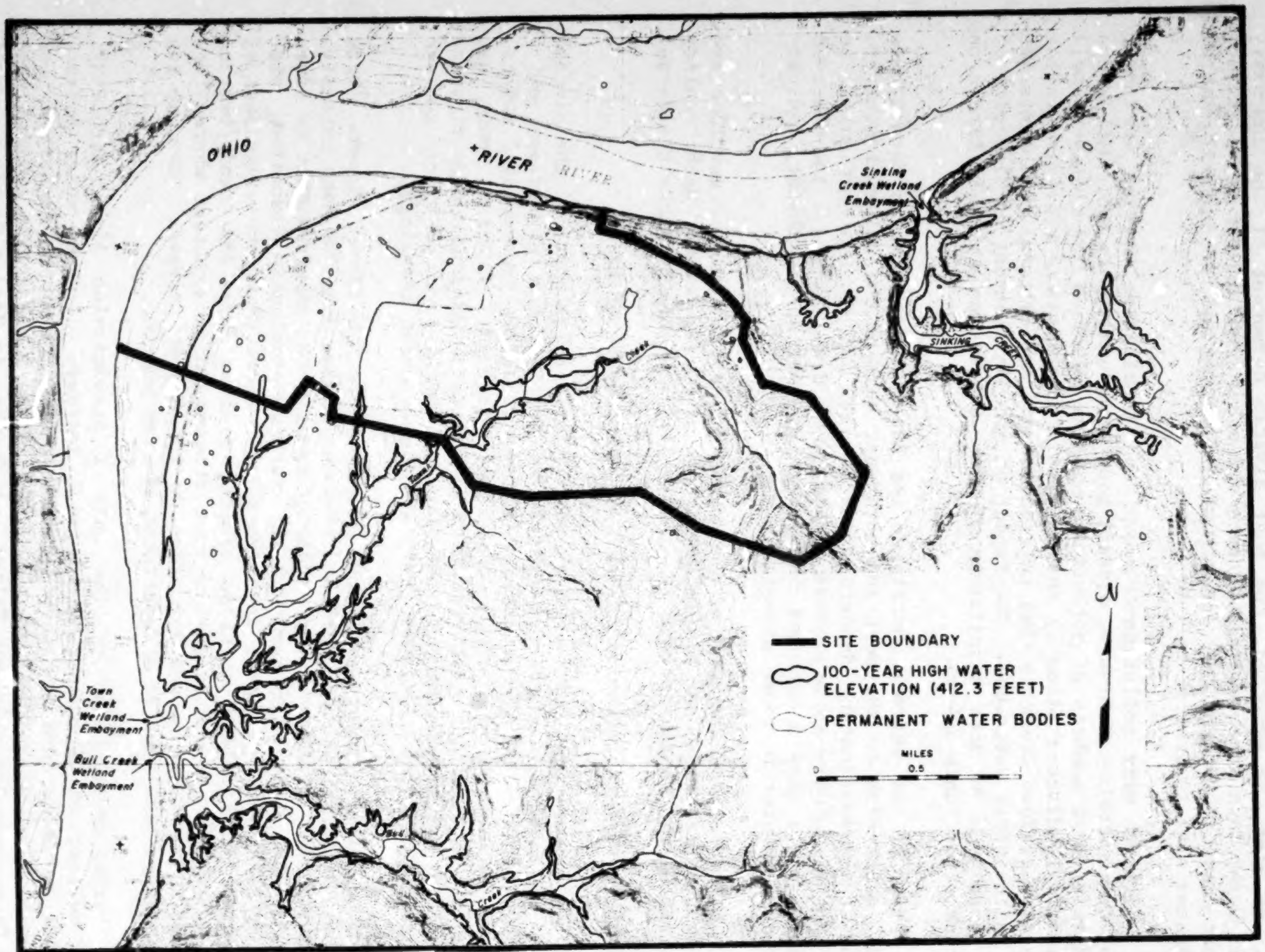
**<0.1 = no measurable velocity.

Source: Texas Instruments Incorporated field data (1979-1980).

Table 3.4-3. Water Quality of Streams Crossed by the Hancock and Breckinridge Transmission Corridors, 1980

	Hancock						Breckinridge					
	Blackford Creek		Sugarcamp Branch		Upper Indian Creek		Bull Creek		Clover Creek		Little Beach Fork of Clover Creek	
Parameter	May	July	May	July	May	July	May	July	May	July	May	July
Dissolved oxygen (mg/ℓ)	12.4	6.8	12.2	8.7	11.6	7.9	10.4	7.1	11.7	6.6	11.2	8.6
Temperature (°C)	12.8	20.6	12.9	17.5	12.1	18.5	13.0	20.0	13.2	21.0	11.8	20.5
pH	6.7	6.8	6.6	7.1	6.6	6.8	6.7	7.0	6.4	7.3	6.5	6.8
Total dissolved solids (mg/ℓ)	13	133	209	104	226	143	242	169	300	157	383	145
Total suspended solids (mg/ℓ)	123	17.2	1.5	4.6	8.0	104	19.5	80	11.5	36.8	2.5	44.4
Turbidity (NTU)	9	10	2	8	11	43	14	24	13	43	9	28
Velocity (ft/s)	1.0	0.3	1.2	0.7	1.5	0.8	0	0	0	0	1.0	0.7
Conductivity (μmhos)	180	235	300	185	345	320	305	270	290	145	390	220

Source: Texas Instruments Incorporated field data (1979-1980).


OHIO
RIVER
RIVER
Sinking Creek Wetland Embayment
SINKING CREEK
Creek
Town Creek Wetland Embayment
Bull Creek Wetland Embayment
Creek
SITE BOUNDARY
100-YEAR HIGH WATER ELEVATION (412.3 FEET)
PERMANENT WATER BODIES
MILES
0
0.5
1
N

SOURCE: USGS Topographic Maps
Sargent & Lundy (1980)

Figure 3.4-4. Water Resources, Breckinridge Site, 1979

in variety and number. Notable differences in the benthic macroinvertebrate community of Town Creek and those of the Hancock site streams are the greater overall density in Town Creek and a greater variety of pollution-sensitive species. As might be expected, the most diverse component of the community occurs in Upper Town Creek where substrate and other habitats are more diverse. Total mean density (and probably diversity) of drifting and free-swimming macroinvertebrates also is greater in Town Creek.

Although many pollution-tolerant and facultative species are among the Town Creek macroinvertebrates, overall good water quality is indicated by the comparatively large numbers of pollution-sensitive mayflies and midges as well as comparatively diverse stonefly and caddisfly components. A primary factor in the status of Town Creek is that cultivation and agricultural pollutants are limited in the upper watershed. The impact of site development on diversity of aquatic biota will be more significant in Town Creek than in Sandy Branch on the Hancock site (Table 3.4-4).

Much of the bedrock underlying the Breckinridge site is Hardinsburg Sandstone, which dips to the west and northwest beneath the alluvial aquifer. Elevation of the Hardinsburg Sandstone varies from 270 to 340 feet msl. The thickness of the aluvium above bedrock varies from 100 to 150 feet. The observed water table levels show a definite decline to the west and northwest, indicating movement of water in those directions.

Streams along the path of the Breckinridge transmission corridor are Bull Creek, Clover Creek, and Little Beach Fork of Clover Creek. Water quality parameters observed in each stream (Table 3.4-3) are within Kentucky standards.

3.4.3.3 Elizabethtown Transmission Corridor Aquatic Resources

Baseline/Impact. From the proposed tie-in point south of the Hancock site, the Elizabethtown corridor crosses 18 waterbodies - 17 streams and 1 pond/marsh complex. One of the streams, Clover Creek, is crossed at 5 points. Within the corridor at all stream crossings, virtually all tree canopy has been removed. Significant herbicide-related stress is present among riparian vegetation and streamside mosses and lichens inside and adjacent to the corridor at the Tar Fork of Clover Creek and Clover Creek crossings.

The largest stream crossing is Tar Fork of Clover Creek. This drainage and those of Clover Creek and the Rough River are the most extensive watersheds crossed by the corridor. Each of the stream crossings that is south of the sites is similar to most of the streams previously described, with silty/sandy substrate and little to no measurable flow. Most crossings east of the potential Breckinridge corridor exhibit greater flow and sandy/bedrock substrates. Erosion is noticeable on most streams but is greatest where livestock occur. Siltation is not a problem in the faster streams. None of the stream crossings will require a Department of Army permit.

During construction of the Unit 2 transmission line, turbidity, suspended solids, and dissolved solids will increase in these water bodies. Impact will be short-term and should be minor using spanning techniques and erosion control procedures as proposed. Hicks Lake, a pond/marsh complex near Franklin Crossroads between Howe Valley and Cecilia in Hardin County, appears to be the most ecologically sensitive water body to be crossed. Hicks Lake wetland area will be crossed by either Unit 2 transmission system, whereas the Tar Fork of Clover Creek complex would be crossed only by the Hancock Unit 2 transmission system.

Table 3.4-4. Water Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 1 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
OHIO RIVER				
Navigation	Construction of barge docking and intake facilities.	Docking facilities will be located from approximately 600 feet (downstream end) to 370 feet (upstream end) inland from the existing river channel line. With docked barges, the facility-to-sailing line distance will be reduced to 265 feet at the upstream end.	Specific docking and intake facility designs have not been proposed for the Breckinridge site.	The Louisville COE has determined that the proposed Hancock facility will present a moderate hazard to navigation. COE ratings of the Hancock and Breckinridge sites relative to navigation impact were extreme and significant, respectively.
		Potential for barge breakaway at the docking facilities.		The potential for breakaway barges will be reduced by having a tow boat at the site whenever barges are docked.
		Intake structures will be 450 feet away from sailing line and 22 feet deep.		Intake structures should have no significant impact on navigation.
	Barge traffic.	Increase of 5% over current traffic through Cannelton Lock and Dam.	Same.	Minor impact.
Water Availability	Withdrawal of cooling water makeup from Ohio River.	Maximum/average withdrawal of Ohio River 7Q10 is expected to be 0.26/0.15%. Project withdrawals essentially represent consumptive use.	Same.	Minor impact. The project will represent a 26.8% increase over recent total withdrawals in this part of the Ohio River, which is within ORBC expectations that predict a tenfold increase in consumptive use in this area by 2020. By then, this project will represent only about 3% of the predicted increase in power plant consumptive use.
		Water availability for aquatic biota, wildlife, recreation,	Same.	No significant impact.

Table 3.4-4. Water Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 2 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Water Availability (Cont.)		and water volume for navigation.		
Water Quality	Site preparation and construction of docks, intake structures, discharge structures, near-shore buildings, etc. along Ohio River.	Increased turbidity, suspended solids, and dissolved solids in the Ohio River. Streambed and onshore disturbances will add organic materials, nutrients, and inorganic particles to the water column.	Same.	Increased turbidity, expected to be greater than increased suspended solids, probably will cause temporary avoidance of the area by fish, waterfowl, and secondarily, fishermen and hunters; will be most severe from April through November 1984-1986. Impact on aquatic biota, wildlife, and recreation is expected to be minor and short-term due to existing turbidity and limited number of game fish and pollution-intolerant species in the Ohio River.
	Operation of barge facilities.	Disturbance of streambed will increase silt load in the Ohio River downstream from the facility.	Same.	Barge movement will cause some instream erosion, and constant turbulence will resuspend ambient silt and prevent disposition in the area. Contributions to existing high sediment load will be for life of the project.
		Potential for spills of coal, limestone, oil, and other chemicals.	Same.	Increased suspended solids from coal and limestone spills would have greatest impact on downstream municipalities using river water for domestic supply. However, the 70-mile distance to the nearest such user (Evansville) should reduce this to an insignificant impact. Oil and chemical spills would have greater impact, although the possibility of these spills and impact will be minimized

Table 3.4-4. Water Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 3 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences		Duration/Significance
		Hancock Site Alternative	Breckinridge Site Alternative	
Water Quality (Cont.)				by adherence to planned oil handling and spillage procedures.
	Effluent discharge to the Ohio River.	Discharge rate at maximum capacity will be 3.7 cfs. Parameters requiring 100:1 dilution in a 100-foot mixing zone to meet water quality criteria include fluoride, barium, sulfate, selenium, and chloride. Parameters that will not meet water quality criteria with a mixing zone include iron, manganese, mercury, phenol, cyanide, cadmium, lead, and chromium. Total suspended solids expected to be 400 mg/l.	Assumed same.	Only those parameters currently above KY standards in river water will exceed standards at the edge of the mixing zone. These parameters will meet standards at a point where discharge velocity is 2 feet per second, so that no measurable impact on aquatic life or water supply is expected.
	Heat discharge to the Ohio River.	Temperature of effluent will vary with time of year and load factor. Maximum/average summer temperature is expected to be 96/82°F; maximum/average winter temperature 69/64°F. At maximum capacity and temperature differential (27°F), a 2°F isotherm is expected to occur after a 100:1 dilution.	Assumed same.	No significant impact is expected.
	Synergistic effects from other industrial discharges along the Ohio River.	Mixing of discharges from KU and the Willamette Industries paper plant.	No discharges are presently located on the Ohio River in proximity to the proposed discharge point. Possible mixing of discharges from proposed H-Coal facility, although no discharge is currently planned from H-Coal.	No significant impact is expected from combined discharges of KU and Willamette due to the 4 mile distance between discharges and the minor potential for chemical reaction between an effluent dominated by organic materials (paper plant) and one dominated by inorganic

Table 3.4-4. Water Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 4 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	Environmental Consequences Breckinridge Site Alternative	Duration/Significance
Water Quality (Cont.)				materials (power plant).
Aquatic Biota	Placement of barge facilities and intake and discharge structures.	Elimination of a limited area of aquatic bottom habitat and creation of structure for fish and certain berthic organisms.	Same.	Minor impact throughout the life of the power plant. Habitat diversity currently limited by river management.
	Barge traffic.	Continuous disturbance of bottom sediments could stress benthic community in the immediate vicinity of the dock.	Same.	Minor impact during the life of the power plant due to predominance of pollution tolerant species.
	Intake of cooling water makeup.	Entrainment of aquatic organisms, mainly fish eggs, fish larvae, and planktonic algae and zooplankton.	Sa[illegible].	Potentially greater entrainment at the Hancock site if higher densities of fish eggs and larvae are present as shown in one year's collecting data. Impact is minimized by intake structure specifications (see text).
GROUNDWATER	Groundwater use from onsite wells.	Maximum/average use is expected to be 1046/802 gpm (1.5/1.1 mgd). Groundwater consumption in Hancock County averages 26 mgd known pumpage. Potential lowering of alluvial aquifer water table from combined withdrawals of the power plant and the existing Willamette facility.	Same. Known pumpage averages 0.3 mgd in Breckinridge County. Potential lowering of alluvial aquifer water table from combined withdrawals of the power plant and the proposed H-coal facility.	No significant stress is expected since the major groundwater source is the alluvial aquifer which is recharged by the Ohio River. Stress, if any occurs, will be greater on supplies in Hancock County. Rapid recharge from the Ohio River should preclude significant impacts from combined withdrawals on either site.
	Groundwater recharge	Reduced recharge of bedrock aquifers in landfill areas. Increased runoff and decreased percolation from deposition of cementitious waste products.	Same.	No significant impact expected on groundwater supplies since these bedrock aquifers contribute little to municipal supplies capped in the project area and much recharge of these aquifers probably occurs

Table 3.4-4. Water Resources and Environmental Consequences of the Hancock Project, Hancock Site and Breckinridge Site Alternatives (Sheet 5 of 5)

Affected Environment	Source of Impact or Effect	Environmental Consequences Hancock Site Alternative	 Breckinridge Site Alternative	Duration/Significance
GROUNDWATER (Cont.)				farther inland.
	Possible leaching of effluents from holding ponds, coal and limestone storage areas, and landfill areas onsite.	Potential for altering groundwater characteristics. Existing high levels of iron and nitrates could be increased by the project.	Assumed similar.	Soil characteristics indicate relatively high permeability, so that liners will be required for ponds. The stabilized waste will reduce leaching. Significance of groundwater effects from this relatively new stabilized waste system is unknown.
ONSITE WATER RESOURCES	Construction activities, landfill activities.	Higher levels of total dissolved solids, turbidity in Sandy Branch, Muddy Branch, and Indian Creek.	Similar impact to upper Town Creek.	Suspended solids discharge to streams from land-clearing activities is expected to be minor due to implementation of erosion and runoff controls. Increased total dissolved solids are not expected to have significant impacts on aquatic biota. Greater impact expected on the Breckinridge site due to presently better water quality in upper Town Creek.
	Channelization of onsite streams.	Sandy Branch will lose its present character.	Upper Town Creek will lose its present character.	Decrease in diversity of aquatic communities in onsite streams. Impact on pollution-intolerant species will be greater on the Breckinridge site.
	Clearing and construction along Unit 1 and 2 corridors.	Increased turbidity, suspended solids, and dissolved solids in streams crossed by the corridors.	Same.	Minor, temporary loss of some organisms. No significant lasting impact.
	Aerial herbicide application during corridor maintenance.	Potential for damage from herbicide drift.	Same.	No significant impact is anticipated with proper application of herbicides.

3.5 ENVIRONMENTAL CONCERNS

This section addresses those environmental elements, other than air and water quality, that have been identified by Federal or other agencies for special management procedures. Most of these elements have been mentioned in preceding sections. Their status in the Hancock project area is summarized in this section, and laws, regulations, or other directives applicable to each element are cited.

3.5.1 Historic and Archaeological Resources

National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.)
Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469 et seq.)
Protection and Enhancement of the Cultural Environment (Executive Order 11593)

The National Historic Preservation Act protects historic and cultural properties that are eligible for or on the National Register of Historic Places. It established the Advisory Council on Historic Preservation and requires that Federal agencies involved in Federal, Federally assisted, or Federally licensed actions afford the Council an opportunity to comment on actions that affect properties included in or eligible for inclusion in the National Register of Historic Places. The Archaeological and Historic Preservation Act authorizes the Secretary of the Interior or designee to undertake data recovery or preservation activities if an action may cause irreparable loss of significant paleontological, historic, or archaeological data. Executive Order 11593 directs Federal agencies, in consultation with the Advisory Council, to institute procedures to assure their plans and programs contribute to the preservation and enhancement of nonfederally owned historic and cultural properties. Regulations implementing the National Historic Preservation Act (36 CFR 800) require Federal agencies to consult with State Historic Preservation Officers (SHPO) to determine effects that an action may have on historic and cultural properties. Accordingly, EPA Region IV consulted with State Historic Preservation Officers of Indiana and Kentucky to determine the status of standing structures and archaeological sites in the project area.

Archaeological and historical resources are nonrenewable. The impacts of disturbing archaeological and historical resources range from direct destruction of specific sites to changes in the integrity of the setting or feeling of the property that contributes to its significance (36 CFR 800). Other possible adverse effects include isolation of the site from the surrounding environment; introduction of out of character visual, audible, or atmospheric elements; neglect; or transfer or sale of the property without adequate preservation restrictions.

Each of the cultural sites of the developed areas will be indirectly affected by land modification activities: the predominately rural character of the plant site area will be changed to an industrial setting, and the presence of transmission lines in rural areas will create an out of character visual element. Construction of buildings, roads, pipelines and docks on the plant site will disturb archaeological and historic sites on lowland areas and along the Ohio River, while landfills will alter those sites in uplands. Because of extensive preconstruction evaluation and salvage and mitigation during construction, if warranted, loss of undiscovered sites is not expected.

Numbers of significant archaeological sites and historical standing structures within view or on either the Hancock or Breckinridge site are:

Hancock Site

Indiana side of Ohio River:	3 standing structures were determined by the Indiana SHPO to be eligible for nomination to the National Register. It was further determined that the Hancock project would have no adverse impact on these structures.
Hancock site:	33 archaeological sites identified on the Hancock site were recommended by the Kentucky SHPO for testing to determine eligibility for nomination to the National Register. 5 of these sites are now believed outside the site boundaries. No standing structures surveyed on the Hancock site were determined by the Kentucky SHPO to be eligible for nomination to the National Register. 7 historic cemeteries occur on the Hancock site.

Breckinridge Site*

Indiana side of Ohio River:	1 standing structure was determined by the Indiana SHPO to be eligible for the National Register.
Breckinridge site:	5 archaeological sites identified on the Breckinridge site were recommended by the Kentucky SHPO for testing to determine eligibility for nomination to the National Register. 2 standing structures on the Breckinridge site are on the National Register: the Holt House and the Holt Chapel. The Holt House will not be directly affected by construction activities but will be subject to impacts from increased noise, traffic, and fugitive dust. The Holt Chapel is in a location that will be part of the plant facility complex. No standing structures surveyed on the Breckinridge site were determined by the Kentucky SHPO to be elibgible for nomination to the National Register.

3 historic cemeteries occur on the
Breckinridge site.

*The archaeological survey of the Breckinridge site was only 65% complete, so that other significant archaeological sites may be present. Because that part of the site yet to be surveyed is in upland rather than lowland areas near the river, it is believed that few, if any, additional significant sites will be identified.

One standing structure along the Elizabethtown Corridor was determined by the Kentucky SHPO to be eligible for nomination to the National Register. Its viewshed will be affected by construction of the Unit 2 transmission line regardless of which site is developed. The aesthetic impact on its viewshed will be intensified by the addition of the new line for the long-term and it will be subjected to increased fugitive dust, traffic, and noise during short-term construction activities.

3.5.2 Prime Farmland

Although not protected by Federal law except on lands proposed for surface mining (Public Law 95-87), prime and unique farmlands are addressed by USDA Soil Conservation Service policy (7 CFR 657). SCS has expressed concern about any action that tends to impair the productive capacity of American agriculture and has set policy to make and keep current an inventory of prime farmland and unique farmland, in cooperation with state and local agencies. SCS personnel, specifically the State Conservationists, are to provide leadership for inventories of important farmlands for the state, county, or other entity, and prepare a statewide list of soil mapping units that meet the criteria for prime farmland (as identified in 7 CFR 657).

The SCS State Conservationist for the Commonwealth of Kentucky issued a preliminary listing of Prime Farmland Soils of Kentucky in May 1979 (Kentucky Invent. & Monit. Bulletin No. KY 42-9-4). The list, which will be finalized following coordination with other states, as provided for in SCS policy, contains some soil types that must meet specified flooding and/or drainage criteria to qualify as prime farmland. According to SCS policy, onsite surveys may be necessary for official determination of the status of these soil types. Basically, candidate soils for prime farmland status are those that have productive qualities and occupy relatively level terrain.

Prime farmland soils occurring on the project site will be destroyed by construction and landfill activities.

Hancock Site. A comparison of the Kentucky prime farmland soil types with those surveyed and mapped for the Hancock site (SCS 1974) revealed that 21 of 40 map units are prime farmland soil types. Most of the 21 soil types, some limited in extent, must be field-checked to determine status as prime farmland (Kentucky DNREP, personal communication 1980). Altogether, possible and known prime farmland comprises about 45%, or 1050 acres, of the site.

Breckinridge Site. A comparison of the Kentucky prime farmland soil types with those preliminarily identified on the Breckinridge site (Breckinridge County SCS, personal communication 1980) revealed that 21 of 42 known map units are prime farmland soil types. Most of these also must meet flooding and/or drainage criteria for a determination of prime farmland. Altogether, identified possible and known prime farmland comprises about 45%, or 1125 acres, of the site. The SCS survey has not been finalized on about 20% of the site, so that extents of known and possible prime farmland cannot be estimated.

3.5.3 Wetlands

Protection of Wetlands (Executive Order 11990)

Like the Executive Order pertaining to the protection and enhancement of the cultural environment, this and similar orders were issued in furtherance of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). Executive Order 11990 requires Federal agencies conducting activities and programs affecting land use, including but not limited to water and related land resouces planning, regulating, and licensing activities, to avoid, to the extent possible, adverse impacts associated with the destruction or loss of wetlands. It further requires Federal agencies to avoid support of new construction in wetlands if a practicable alternative exists. Wetlands as defined by the Order generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Hancock Site. Wetlands inventoried by the Kentucky Department of Fish and Wildlife that are associated with the Hancock site are Indian Lake and a small lake near Muddy Branch. Both are Type 5 wetlands, which are inland open fresh water (U.S. Fish and Wildlife Service 1979). A wetland that has not been inventoried by Kentucky lies inside the northern boundary of the site. This is a shallow marsh that ranges in extent from approximately 4 acres during spring to about 1 acre during summer. The existing hydrological regime in all of these locations will be altered by project control over natural drainage patterns and runoff.

Breckinridge Site. The Breckinridge site is associated with one wetland embayment inventoried by the Kentucky Department of Fish and Wildlife: Town Creek Embayment. In its study of the natural, historical, and recreational resources of the Ohio River Basin, the Ohio River Basin Commission (1978) recommended that the Town Creek Embayment be investigated within 1 to 5 years to determine applicability of the area as a Commission project for conservation. It will be affected by alteration of natural drainage patterns and runoff.

3.5.4 Floodplains

Floodplain Management (Executive Order 11988)

Executive Order 11988 was issued in furtherance of the National Flood Insurance Act of 1968 (42 U.S.C. 4001 et seq.) and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Stat. 975) as well as NEPA. In addition to directing Federal agencies to reduce the risk of flood loss and minimize impact of floods on human safety, the order also requires that Federal agencies evaluate the effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects on the natural and beneficial values served by floodplains. Floodplains defined by the order are, at a minimum, those areas subject to a 1% or greater chance of flooding in a given year.

Hancock Site. The 100-year floodplain elevation at the Hancock site is 406.3 feet msl. Elevation of the 1937 flood of record at the site, adjusted for recent lock and dam construction, is 407.9 feet msl. Areas within the 100-year floodplain on the site include locations north and east of the Louisville and Nashville R.R. and locations bordering Sandy Branch (see Figure 3.4-3). The floodplain associated with Sandy Branch will be destroyed as the upper stream is channelized to accomodate site runoff. Construction of onshore berms and structures associated with the coal and limestone unloading system and the intake and discharge systems will occur in the floodplain between river miles 715 and 716.5.

Breckinridge Site. At the Breckinridge site, the 100-year floodplain elevation is 412.3 feet msl. Adjusted elevation of the 1937 flood of record is 414.3 feet msl. Areas within the 100-year floodplain on the Breckinridge site include locations west of the Louisville and Nashville R.R. and locations bordering Town Creek (see Figure 3.4-4). As on the Hancock site, the floodplain along Town Creek will be destroyed as channelization and other modifications are done to accomodate site runoff and in this case, to construct landfill areas. Onshore berms and structures associated with the coal and limestone handling system and the discharge system will be constructed in the floodplain at river miles 703.5 and 705.5.

3.5.5 Fish and Wildlife Resources

Fish and Wildlife Coordination Act of 1965 (16 U.S.C. 661 et seq.)

One of the provisions of the Act requires Federal agencies involved in actions that will impound, divert, deepen, or otherwise control or modify for any purpose a natural stream or other water body to take action to protect fish and wildlife resources that may be affected. Federal agencies involved in such actions are to consult with the U.S. Fish and Wildlife Service and the appropriate Commonwealth agency to determine measures to conserve and improve wildlife resources that may be affected by the actions.

Hancock Site. The Hancock site has three streams: Indian Creek, Muddy Branch, and Sandy Branch. All have natural riparian habitat and none has been channelized. Sandy Branch, as mentioned, will lose its natural character. It is the only known habitat on the site for the pirate perch, a species that is in danger of extinction in Kentucky. Topographic changes associated with landfill operations will alter runoff patterns and headwaters of Muddy Branch and Indian Creek. Water quality changes in these streams are expected to be greater total dissolved solids, iron, and manganese. These are expected to have no impact on existing biota.

Breckinridge Site. The single stream on the Breckinridge site is Town Creek, which also has natural riparian habitat and has not been channelized, although pool elevation of the Ohio River has flooded its mouth. Town Creek will be altered significantly to form a channel for site runoff. Its headwaters will be altered as topography is changed during landfill operations. Pollution-intolerant bottom organisms will be displaced, perhaps indirectly affecting fish and wildlife resources through the food chain.

3.5.6 Threatened and Endangered Species

Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)

The Act protects threatened or endangered plant and animal species and their critical habitat as designated by the Secretary of the Interior. Regulations implementing the Act (50 CFR 402) require Federal agencies to consult with U.S. Fish and Wildlife Service if listed species or habitat essential for their survival may be affected by Federal projects, plans, licenses, and other activities. Accordingly, EPA Region IV consulted with FWS to confirm the status of threatened and endangered species in the project area.

No threatened or endangered plants or animals listed by DOI were observed during vegetation and wildlife surveys on the Hancock and Breckinridge sites. Records of Federally listed species in western Kentucky do not include Hancock, Breckinridge, and Hardin counties (FWS, personal communication 1978; Kentucky Nature Preserves Commission 1979).

During development of this EIS program, the Kentucky Department for Natural Resources and Environmental Protection requested that species listed on the Kentucky Nature Preserves Commission's Plant and Animal Element List be addressed. These plants and animals are among the elements of natural diversity, both biological and physical, that are considered threatened with extirpation from the state if something is not done in their behalf. It is the intent of the Commission to identify, map, and monitor these elements to maintain the natural world in the diverse state in which it developed. Observations during onsite surveys of species on the Animal Element list will add records to those currently in the Commission's files.

Hancock Site. Observations indicate that the evening bat is a resident of Jeffry Cliff and associated woodlands. These locations also provide roosting sites for the black vulture. Sightings of other listed wildlife species on the site included the great blue heron, the great egret, and the marsh hawk. One fish on the Commission's list, the pirate perch, was seined from Sandy Branch. Larvae of another, the paddlefish, were collected at Ohio River Mile 717. Known onsite habitat of the pirate perch probably will be destroyed, but habitat requirements and Kentucky distribution indicate Muddy Branch and Indian Creek could support the species. Impacts on the evening bat and black vulture are uncertain and depend upon their tolerance of activity near the cliff. No significant impacts are expected to the other species.

Breckinridge Site. Three birds on the Commission's list were sighted on or near the Breckinridge site: the black vulture, the great blue heron, and the great egret. Larvae of the paddlefish were collected at Ohio River Mile 707 and an adult river shiner was collected at the same location. No impacts are expected to the bird species based on observations of occasional site usage. Impacts to the fish species are expected to be slight based on minimal entrainment and impingement due to cooling water intake and discharge.

4.0 THE PROJECT'S UNAVOIDABLE ADVERSE IMPACTS, COMMITMENTS OF RESOURCES, AND CONFLICTS

Development of the proposed action will involve a number of tradeoffs and commitments of resources. Although the proposed action includes many state-of-the-art environmental impact control procedures and technologies, certain impacts are unavoidable, while others are considered insignificant compared with the cost of eliminating them. Most unavoidable adverse impacts and resource commitments represent tradeoffs between the objectives of the project and its use of the environment; however, emissions and effluent controls represent tradeoffs of impacts among air, water, and land resources. Construction and operation of the generating station and transmission facilities per se do not conflict with the objectives of Federal and other governmental plans, but proposed location of the generating station on the Hancock site is objectionable to local government and apparently to certain components of Commonwealth government as well. Location of the generating station on the Breckinridge site could interfere with Commonwealth and Federal plans.

4.1 UNAVOIDABLE ADVERSE IMPACTS

Construction and operation of Hancock Generating Station Units 1 and 2 and proposed transmission facilities will have long-term impacts on more than 2500 acres of land (including cultural resources), associated water resources (including the Ohio River adjacent to the site), and the atmosphere and biological resources within the influence of the emissions plume. Short-term impacts will occur in certain areas of the human environment until sufficient monetary returns are available or assured for upgrading tax-supported facilities and activities (including road construction) and until sufficient time has elapsed to allow acceptance of the project.

On the generating station site, existing soil structure, topography, drainage patterns, vegetation, and cultural significance will be destroyed. The area of the plant facilities probably will be permanently converted from agricultural and woodlands land uses to industrial land use. Landfill areas, although perhaps available for other uses in the long term, will not support equivalent agricultural or woodland uses for at least several decades after plant shutdown.

Loss of the existing terrestrial characteristics and drainage patterns would involve more than 1000 acres of known and possible prime farmland soils on either site, loss of riparian vegetation on either site, and loss of special growing sites for wetlands and mixed mesophytic forest vegetation on the Hancock site. The larger Breckinridge site (2480 acres vs. 2350 for the Hancock site) contains about 75 acres more known or possible prime farmland than does the Hancock site, but riparian and other disturbance-sensitive sites are more extensive on the Hancock site. This includes the number of known archaeological sites requiring additional investigation prior to site development (28 on the Hancock site vs. 5 on the Breckinridge site) and the visual character of the site. The Breckinridge site includes two structures on the National Register of Historic Places but both are abandoned, and one has deteriorated (the Holt Chapel) and the other (the Holt House) is in poor condition. Completion of the soil and archaeological surveys on the Breckinridge site would not be expected to change the relative status of the sensitive sites because areas remaining to be surveyed are primarily in recently disturbed uplands.

The stream to be used for collecting runoff from the plant facilities locations will lose its present natural character and become a channel that will have significantly diminished life-support value. On the Hancock site, this would be Sandy Branch, which has a greater diversity of habitats and apparently better water quality than the site's other two streams. However, channelization of Town Creek, the only stream on the Breckinridge site, probably would be a greater impact on onsite water resources, as indicated by a greater diversity of pollution-sensitive aquatic biota in its upper reaches. There is no indication that drift from streams on either site contributes significantly to aquatic communities of the Ohio River.

Intake of cooling water will entrain and impinge small quantities of aquatic biota of the Ohio River for the life of the generating station. Construction of the barge docking and unloading facilities will temporarily but severely disturb bottom communities of approximately one mile of shoreline. Operation of these facilities will create constant turbulence, and impede reestablishment of intolerant species, although few. One year's sampling data indicate that somewhat greater quantities of fish eggs and larvae and other planktonic fauna likely to comprise much of the entrained and impinged biota may occur at the Hancock site. No Federal threatened or endangered species would be impacted at either site. Species on the Kentucky Nature Preserves Commission's Animal Element List could be entrained or impinged at either site, producing slight impacts on their populations.

An additional impact from the barge docking and unloading facility as now proposed at the Hancock site will be the facility-to-sailing line distance, which the Louisville COE has determined will present a moderate hazard to navigation on the Ohio River. COE ratings of the Hancock and Breckinridge sites relative to navigation impact were extreme and significant, respectively.

Neither drinking water nor aquatic organisms are expected to be impacted appreciably by pollutants in the plant's discharge to the Ohio River. Eight water quality parameters currently exceed Kentucky standards in ambient river water and therefore cannot meet standards at the edge of a mixing zone. Concentrations of these pollutants will be less than 6% above ambient levels at the mixing zone edge. Although the cooling water discharge will not add pollutants, there will be slight contributions to accumulations of heavy metals in river sediments from fallout of trace elements in chimney emissions.

Although air quality standards apparently will not be violated by chimney emissions or by fugitive dust emissions from the coal and limestone handling system, background levels of SO_2, TSP, and NO_x will be increased in the vicinity of the plant and small contributions will be made to potential vegetation stress from these substances, acid precipitation, and trace element deposition. It is expected that the possible impact of fugitive coal dust on the bleached pulp product of Willamette Industries adjacent to the Hancock site will be mitigated by appropriate control mechanisms.

Removal of SO_2 and suspended particulates from the boiler flue gas will generate about 1.17 million tons of stabilized solid waste each year for the life of the plant. In addition to causing impacts to terrestrial resources mentioned above, onsite disposal of this waste will degrade surface water quality and groundwater quality, although possibly not impacting standards and/or human health. Should groundwater that is used for domestic purposes be affected, treatment for total dissolved solids and hardness may be necessary.

Background noise levels will be increased significantly, especially at the Breckinridge site, although levels off the plant site are expected to remain below standards that protect hearing loss. Impact on nearby residents will be similar at the two sites, based on projected locations of greatest increase in noise levels.

During peak construction on either site, there will be significant impacts on traffic crossing the Ohio River between Cannelton, Indiana and Hawesville, Kentucky and on that along U.S. 60. This will exacerbate the strain expected on project area police protection. Rental housing demand during these periods probably cannot be met with existing units, especially with the Hancock site alternative. Project area motels and other temporary housing units will be stressed regardless of which site is developed. The 3-year hiatus between peak construction work forces for Units 1 and 2 will be a distinct disadvantage to project area governments and businesses planning for the project.

The most significant social impacts of the Hancock site alternative probably have already occurred. Resistance to the project in that county has been evident since the project was announced in late 1978, and roles, reputations, and attitudes have been formulated around it. The acceptance of inmigrant construction workers may be hindered by perceived or real resistance, although most resistance should dissipate by the time operating personnel arrive. Similar impacts have not occurred in Breckinridge County, nor are they expected, although some landowners on both sites are opposed to giving up their land.

Development of the Unit 1 transmission system will degrade landscape scenic quality and create incompatible visual contrasts, especially in hilly woodland areas. Impacts will be greater along the Hancock corridor. Use of steel towers for Unit 2 transmission from either site will create a significant visual contrast with the existing wooden towers along the Elizabethtown corridor.

Fugitive dust, burning of slash, and vehicle emissions will contribute to short-term local air pollution along the corridors. Ambient noise levels of the predominantly rural locales also will be increased significantly during construction, and a slight buzzing sound may be associated with transmission, especially during inclement weather.

Streams and other water bodies along the transmission corridors will have short-term increases in turbidity, suspended solids, and dissolved solids. Several crossings of Clover Creek and tributaries by the Elizabethtown corridor between the Hancock corridor and Breckinridge corridor would make this and most other impacts associated with Unit 2 transmission somewhat greater with the Hancock alternative.

Impacts to archaeological resources along the corridors will be determined by onsite surveys once alternative rights-of-way have been proposed.

4.2 RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Construction and operation of Hancock Units 1 and 2 and transmission facilities will make available 1300 MW of electrical energy for Kentucky Utilities customers. During the plant life, local and regional economic activity will be enhanced. A significant economic stimulation will occur locally during the construction phase, when the greatest influx into the project will occur. The temporary influx will, however, strain existing police protection and housing especially, and stress social structure. The Hancock site alternative has already impacted local social characteristics. Social productivity is expected to be stimulated during the operational phase. In the long-term, the economic and social productivity stimulated by the generating station is likely to be maintained, partly because additional industry and business will slow the significant outmigration currently characteristic of the project area.

The economic productivity from the generating station will be greater than that derived from existing land uses, but as much as 1000 acres of prime farmland will be preempted. Continued industrial use of the land would be desirable since existing agricultural productivity cannot be restored. Existing biological productivity, especially that of terrestrial systems on the Hancock site and Town Creek on the Breckinridge site, would not recover for several decades, if ever.

Use of the Ohio River by the generating station will be a small increment in reaching a consumptive use level that is projected to possibly impact water quality critical low flow by 2020. Although discharges, emissions, and other plant activities are not expected to significantly diminish productivity of the river, they nevertheless also will represent small increments in pollutant loads. The long-term status of productivity of the river beyond the life of the proposed project depends upon many variables not directly related to the project.

The transmission system is not expected to impact long-term agricultural or biological productivity since relatively few acres of soils will be severely disturbed.

The project will deplete national reserves of nonrenewable resources, as described below.

4.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Hancock Generating Station Units 1 and 2 will consume 105 million tons of coal, 11.7 million tons of limestone, and 910 thousand tons of lime. Construction and operation of the facilities also will require considerable fuel oil, lubricating oils, gasoline, and other petroleum-based products, as well as certain man-made or processed resources that may not be totally recyclable. Among the processed materials are concrete, steel, aluminum, copper, other metals, plastics, and glass. In general, concrete, road materials, and chemicals will be irretrievably commited.

Capital expenditures of more than 2 billion dollars are among the socioeconomic commitments of the project. Skilled manpower used in construction and operation will be irreversibly expended and not available for other uses.

The cultural significance of the developed site will be lost by changing the predominately rural character to an industrial setting. Prime farmland will be irreversibly altered as will other natural resources dependent on existing soil structure, topography, and drainage patterns. These alterations will irretrievably commit existing biological diversity, landscape patterns, and land use options. An undeterminable loss of productive capacity of soils will be an irretrievable commitment of agricultural and biological resources.

The plant will consume relatively small amounts of surface water and groundwater, making them unavailable for other uses. It also will use air and water for dispersal of pollutants and land for storage of solid waste, limiting the availability or capacity of each for additional use.

4.4 CONFLICTS BETWEEN THE PROPOSED ACTION AND THE OBJECTIVES OF FEDERAL, COMMONWEALTH, REGIONAL, AND LOCAL PLANS

The major functional unit of government in the project area is the county, which is operated by a Judge-Executive assisted by 4 to 8 magistrates. The cities of Hawesville, Cloverport, Tell City, Cannelton, and Elizabethtown have elected mayors and city councils. Agencies that are involved in coordinating plans with these governmental bodies include the Hancock County Urban Planning Commission and two agencies of the Commonwealth of Kentucky, the Lincoln Trail Area Development District (including Breckinridge County), and the Green River Area Development District (including Hancock County).

As mentioned in Section 3.1.2, the Kentucky Department of Commerce, in cooperation with various planning agencies, has designated low, level locations along the Ohio River as potential industrial land. Locations so designated inlcude portions of the Hancock and Breckinridge sites. However, because it was not consulted prior to site selection, the Hancock County Urban Planning Commission has stated that Kentucky Utilities disregarded the Commission's goals and policies (formulated with assistance from GRADD) that elicit cooperation from potential industry in selection of industrial sites. The Commission feels that consultation with Kentucky Utilities is necessary to determine whether this goal will be fulfilled: utilization of all land resources within the planning area for their highest and best uses consistent with maximizing public interest and the interest of private property owners.

The Fiscal Court of Hancock County, the City Councils of Hawesville and Lewisport in Hancock County, and the Mayors of Hawesville, Kentucky and Tell City, Indiana oppose construction of the generating station on the Hancock site. The primary issue of the Hancock County political base is the number of permanent jobs ,the generating station will provide relative to the amount of air increment consumed and to the amount of industrial land occupied. Hancock County wishes to expand its industrial base but believes that several smaller manufacturing plants would employ substantially more people and provide greater employment opportunities for Hancock County residents and those of neighboring counties. This, the County feels, would mitigate outmigration of area residents as well as increase County economic activity, most of which is based on manufacturing.

The Secretary of the Cabinet has expressed the concerns of the Commonwealth of Kentucky relative to opposition to the KU plant by the citizens and community groups of Hancock County. Additional concern has been expressed about the impact of KU's proposal on Willamette Industries and the economic consequences should Willamette modify plans to further expand in the Commonwealth.

The Breckinridge County Fiscal Court has expressed approval of the project for Breckinridge County. However, several months after KU's Breckinridge alternative was announced, Ashland Oil proposed the Breckinridge site as a preferred alternative for locating a synthetic fuel plant (H-Coal). Ashland Oil's proposal and the involvement of the Commonwealth of Kentucky in securing land on the site for synthetic fuel development induced KU to change its proposed location on the site, necessitating modifications in site development plans and other materials prepared for evaluation of this alternative. Neither Kentucky nor Federal agencies involved with the projects have explicitly stated that development of the generating station on the Breckinridge site would conflict with development of the synfuel plant. However, should conflict become apparent, indications are that the synfuel plant would be favored for the site.

5.0 LIST OF PREPARERS

5.1 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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John P. Herrmann	Project Officer (1978-1979)
Charles H. Kaplan	NPDES Permit
Joseph O'Conner	Water Quality
Phillip J. Murphy	Biology and Ecology
Allen Lucas	Biology and Ecology
D. Brian Mitchell	Air Resources
Lewis Nagler	Air Resources
Michael J. Harnett	Residuals Management
Howard A. True	Surface Water
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B.S., Biology, Milsaps College
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6.0 COORDINATION

The following Federal, Commonwealth, and local officials and agencies and interest groups have been requested to comment on this impact statement.

6.1 FEDERAL AGENCIES

Corps of Engineers
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Education
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Economic Development Administration
Federal Aviation Administration
Federal Highway Administration
Fish and Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
Heritage Conservation and Recreation Services
National Park Service
Public Health Service
Soil Conservation Service

6.2 MEMBERS OF CONGRESS

Honorable Wendell H. Ford
United States Senate

Honorable Walter D. Huddleston
United States Senate

Honorable Romano L. Mazzoli
United States House of Representatives

Honorable William H. Natcher
United States House of Representatives

6.3 COMMONWEALTH OFFICIALS AND AGENCIES

Honorable John Y. Brown, Jr.
Governor

Department of Agriculture
Department of Commerce
Department of Energy
Department of Fish and Wildlife Resources
Department for Natural Resources and Environmental Protection
Department of Transportation
Geological Survey
Kentucky Heritage Commission

6.4 LOCAL OFFICIALS AND AGENCIES

Green River Area Development District
Lincoln Trail Area Development District
Hancock County Urban Planning Commission
Tell City Economic Development Commission
Hancock County Judge - Executive
Breckinridge County Judge - Executive
City of Hawesville

City of Cloverport
City of Tell City

6.5 INTEREST GROUPS

Indian Lake Club
Kentucky Audubon Society
Kentucky Sierra Club
Kentucky Izaac Walton League
Save the Valley
Valley Watch

7.0 REFERENCES

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8.0 APPENDIXES

8.1 DRAFT NPDES PERMIT

DRAFT

8/14/81

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Kentucky Utilities Company
1 Quality Street
Lexington, Kentucky 40507

is authorized to discharge from a facility located at

Hancock Generating Station
Units 1 and 2
Hancock County, Kentucky

to receiving waters named

Ohio River (001) Sandy Branch Creek (002, 005, 006 and 007), Muddy Branch Creek (003), and Indian Creek (004)

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof. The permit consists of this cover sheet, Part I 8 **pages(s), Part II** 12 **page(s) and Part III ____page(s).**

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight, (5 year period)

____
Date Signed

____
Howard D. Zeller
Acting Director
Enforcement Division

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 001 - Cooling tower blowdown to the Ohio River.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements	
	Daily Maximum Effluent Limitation	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	Continuous	Recorder/Totalizer
Temperature $^{\circ}$C($^{\circ}$F)	35.6(96.0)1/	Continuous	Recorder
Total Residual Chlorine	See Below	1/week 2/	Multiple Grabs
Additional Monitoring	See Part III.C.	See Part III.C.	

Chlorine may be discharged continuously; however, discharge of total residual chlorine shall not exceed a maximum instantaneous concentration of 0.1 mg/l. In the event that the units cannot be operated at or below this level of chlorination, the applicant may submit a demonstration, based on biological toxicity data, that discharge of higher levels of chlorine are consistent with toxicity requirements of the Kentucky Water Quality Standards. Effluent limitations will be modified consistent with an acceptable demonstration.

Discharge of blowdown from the cooling system shall be limited to the minimum discharge of recirculating water necessary for the purpose of discharging materials contained in the process, the further build-up of which would cause concentrations or amounts exceeding limits established by best engineering practice. A report showing how conformance with this requirement will be met, including operational procedures, shall be submitted during the system design stage. Additionally, annual reports shall be submitted along with the first quarterly monitoring report submitted after January 1 of each year. Discharge temperature shall not exceed the lowest temperature of the recirculating cooling water prior to the addition of make-up.

There shall be no discharge of detectable amounts of materials added for corrosion inhibition (including but not limited to zinc, chromium or phosphorus) or any chemicals added which contain the 129 priority pollutants.

CONTINUED

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 001 - Cooling tower blowdown to the Ohio River (Continued)

The company shall notify the Director, Enforcement Division in writing not later than sixty (60) days prior to instituting use of any additional biocide or chemical used in cooling systems, other than chlorine, which may be toxic to aquatic life other than those previously reported to the Environmental Protection Agency. Such notification shall include:

1. name and general composition of biocide or chemical,
2. 96-hour median tolerance limit data for organisms representative of the biota of the waterway into which the discharge shall occur,
3. quantities to be used,
4. frequencies of use,
5. proposed discharge concentrations, and
6. EPA registration number, if applicable.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Plant discharge, except that compliance with mixing zone requirements shall be as defined in Part III.B.

1/ The receiving water shall not exceed (1) a maximum temperature of 31.7°C(89°F), except when upstream temperatures approach or exceed this value, nor (2) a maximum water temperature change of 2.8°C(5.0°F) relative to an upstream control point, outside of a mixing zone which shall not extend for more than 30 meters (100 feet) from the point of discharge at seven-day, 10-year low flow conditions.

2/ From start of chlorination of each unit, analyses shall follow each application of chlorine until sufficient operating experience has been obtained to assure conformance with limitations and then analysis frequency may be reduced to one day per week.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 002, 003 and 004 - Point source runoff from stabilized scrubber sludge disposal area to Sandy Branch Creek, Muddy Branch Creek and Indian Creek, respectively.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements	
	Instantaneous Maximum	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	1/week 2/	Grab
Total Suspended Solids (mg/l)	50 1/	1/week 2/	Grab
Detention Volume	See Below	1/quarter	Calculation(s)
Additional Monitoring	See Part III.C.	See Part III.C.	

The runoff treatment ponds shall be capable of processing the 10-year, 24-hour rainfall event plus all accumulated silt without overflow of the standpipe. Not less than one/quarter , permittee shall ascertain that available settling volume meets these requirements and shall report this finding when submitting Discharge Monitoring Reports.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week 1/.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): point(s) of discharge from treatment pond prior to mixing with other waste streams.

1/ Applicable to any flow up to the flow resulting from a 24-hour rainfall event with a probable recurrence interval of once in ten years.

2/ Sampling of the effluent and inspection of the sand filter and water level shall be conducted at least two times per week during periods when the water level is within 36 inches of the top of the overflow pipe. All periods of overflow shall be reported and representative samples collected for analysis.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 005 1/ - Point source runoff from areas of construction and yard drainage to Sandy Branch Creek (also includes sewage treatment system effluent (OSN 007) during plant construction).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements	
	Instantaneous Maximum	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	1/week 3/	Grab
Total Suspended Solids (mg/1)	50 2/	1/week 3/	Grab
Detention Volume	See Below	1/quarter	Calculation(s)

The runoff treatment ponds shall be capable of processing the 10-year, 24-hour rainfall event plus all accumulated silt without overflow of the standpipe. Not less than one/quarter, permittee shall ascertain that available settling volume meets these requirements and shall report this finding when submitting Discharge Monitoring Reports.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standards units and shall be monitored 1/week 1/.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): point(s) of discharge from treatment system prior to mixing with other waste streams.

1/ Serial number assigned for identification and monitoring purposes.

2/ Applicable to any flow up to the flow resulting from a 24-hour rainfall event with a probable recurrence interval of once in ten years.

3/ Sampling of the effluent and inspection of the sand filter and water level shall be conducted at least two times per week during periods when the water level is within 36 inches of the top of the overflow pipe. All periods of overflow shall be reported and representative samples collected and analyzed.

Note: Limitations and monitoring requirements are not applicable during periods of no discharge

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 006 1/ - Point source(s) runoff from material storage to Sandy Branch Creek.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements	
		Measurement Frequency	Sample Type
Not Applicable	N/A	N/A	N/A

Runoff from the coal and limestone storage piles shall be directed to Pond "C", except that flows in excess of the 10-year, 24-hour rainfall event may be discharged to Sandy Branch Creek. All periods of discharge to Sandy Branch Creek shall be reported.

There shall be no discharge of floating solids or visible foam to Sandy Branch Creek in other than trace amounts.

1/ Serial number assigned for identification and monitoring purposes.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 007 1/ - Sanitary Waste Treatment System effluent to Discharge Serial 005 during construction and subsequently to Pond "C". Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations Other Units (mg/l except as noted)		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	5/week	Grab
BOD_5	30	60	2/month	Grab
Total Suspended Solids	30	60	2/month	Grab
Dissolved Oxygen	See Below		1/week	Grab
Chlorine Residual	N/A	N/A	5/week	Grab
Fecal Coliform 2/(organisms/100 ml)	N/A	N/A	1/quarter	Grab

Effluent shall contain a minimum of 2.0 mg/l of dissolved oxygen at all times.

NOTE : Subsequent to diversion of effluent to Pond "C" no limitations or monitoring requirements will be applicable.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Sewage treatment plant effluent prior to mixing with any other waste stream.

1/ Serial number assigned for identification and monitoring purposes.
2/ Geometric Mean

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of intake and lasting through expiration the permittee shall monitor serial number 008 1/ - Plant Intake

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	Continuous	Recorder or Logs
Temperature °C(°F)	Continuous	Recorder
Additional Monitoring	See Part III.C.	

Approach velocity to the intake screens shall not be greater than 0.15 mps (0.50 fps) design maximum.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
Plant Intake

1/ Serial number assigned for identification and monitoring purposes.

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B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   a. Achieve effluent limitations (001-007) - on start of discharge

   b. Blowdown reports Units 1 and 2 cooling systems (001)
      (1) Initial report - during system design stage
      (2) Annual reports - with first quarterly report for each year

   c. Discharge plume verification (Part III.B.)
      (1) First report - 15 months after commercial date of Unit 1
      (2) Second report - 15 months after commercial date of Unit 2

   d. Reports of pond A, B and C levels (Part III.B.)
      (1) Pond level within 12 inches of spillway, but no discharge - Quarterly with DMR's
      (2) Discharge - In accordance with Part II.A.3.c. procedures

   e. Toxic scan data (Part III.F.)
      (1) Submit data - Twelve months after commercial operation of Unit 1

   f. Metal cleaning waste offsite treatment (Part III.G.)
      (1) Submit details - 180 days prior to cleaning operation

   g. Groundwater monitoring program (Part III.H.)
      (1) Implement - One year prior to operation of Unit 1
      (2) Reports - Quarterly with DMR's

   h. Erosion and sedimentation control program (Part III.J.)
      (1) Implement - On start of construction
      (2) Reports -
         (a) First year - quarterly with DMR's
         (b) After first year - semiannually with DMR's

   i. Archaeological studies and consultations (Part III.K.)
      (1) Complete prior to on-site construction

   j. Pond Liners (Part III.M.)
      (1) Certification of permeability - 90 days before pond operation.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

A. MANAGEMENT REQUIREMENTS

1. Discharge Violations

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than, or at a level in excess of, that identified and authorized by this permit constitutes a violation of the terms and conditions of this permit. Such a violation may result in the imposition of civil and/or criminal penalties as provided in Section 309 of the Act.

2. Change in Discharge

Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application at least 180 days prior to commencement of such discharge. Any other activity which would constitute cause for modification or revocation and reissuance of this permit, as described in Part II (B) (4) of this permit, shall be reported to the Permit Issuing Authority.

3. Noncompliance Notification

a. Instances of noncompliance involving toxic or hazardous pollutants should be reported as outlined in Condition 3c. All other instances of noncompliance should be reported as described in Condition 3b.

b. If for any reason, the permittee does not comply with or will be unable to comply with any discharge limitation specified in the permit, the permittee shall provide the Permit Issuing Authority with the following information at the time when the next Discharge Monitoring Report is submitted.

   (1) A description of the discharge and cause of noncompliance;
   (2) The period of noncompliance, including exact dates and times and/or anticipated time when the discharge will return to compliance; and
   (3) Steps taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

c. Toxic or hazardous discharges as defined below shall be reported by telephone within 24 hours after permittee becomes aware of the circumstances and followed up with information in writing as set forth in Condition 3b. within 5 days, unless this requirement is otherwise waived by the Permit Issuing Authority:

(1) Noncomplying discharges subject to any applicable toxic pollutant effluent standard under Section 307(a) of the Act;

(2) Discharges which could constitute a threat to human health, welfare or the environment. These include unusual or extraordinary discharges such as those which could result from bypasses, treatment failure or objectionable substances passing through the treatment plant. These include Section 311 pollutants or pollutants which could cause a threat to public drinking water supplies.

d. Nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

4. Facilities Operation

All waste collection and treatment facilities shall be operated in a manner consistent with the following:

a. The facilities shall at all times be maintained in a good working order and operated as efficiently as possible. This includes but is not limited to effective performance based on design facility removals, adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls (including appropriate quality assurance procedures); and

b. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during noncritical water quality periods and carried out in a manner approved by the Permit Issuing Authority.

c. The permittee, in order to maintain compliance with this permit shall control production and all discharges upon reduction, loss, or failure of the treatment facility until the facility is restored or an alternative method of treatment is provided.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to waters of the United States resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature of the noncomplying discharge.

6. Bypassing

"Bypassing" means the intentional diversion of untreated or partially treated wastes to waters of the United States from any portion of a treatment facility. Bypassing of wastewaters is prohibited unless all of the following conditions are met:

a. The bypass is unavoidable-i.e. required to prevent loss of life, personal injury or severe property damage;

b. There are no feasible alternatives such as use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment down time;

c. The permittee reports (via telephone) to the Permit Issuing Authority any unanticipated bypass within 24 hours after becoming aware of it and follows up with written notification in 5 days. Where the necessity of a bypass is known (or should be known) in advance, prior notification shall be submitted to the Permit Issuing Authority for approval at least 10 days beforehand, if possible. All written notifications shall contain information as required in Part II (A)(3)(b); and

d. The bypass is allowed under conditions determined to be necessary by the Permit Issuing Authority to minimize any adverse effects. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration to the extent feasible.

This requirement is waived where infiltration/inflow analyses are scheduled to be performed as part of an Environmental Protection Agency facilities planning project.

7. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering waters of the United States.

8. Power Failures

The permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures either by means of alternate power sources, standby generators or retention of inadequately treated effluent. Should the treatment works not include the above capabilities at time of permit issuance, the permittee must furnish within six months to the Permit Issuing Authority, for approval, an implementation schedule for their installation, or documentation demonstrating that such measures are not necessary to prevent discharge of untreated or inadequately treated wastes. Such documentation shall include frequency and duration of power failures and an estimate of retention capacity of untreated effluent.

9. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any waters of the United States.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Permit Issuing Authority and/or authorized representatives (upon presentation of credentials and such other documents as may be required by law) to:

a. Enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit;

c. Inspect at reasonable times any monitoring equipment or monitoring method required in this permit;

d. Inspect at reasonable times any collection, treatment, pollution management or discharge facilities required under the permit; or

e. Sample at reasonable times any discharge of pollutants.

2. Transfer of Ownership or Control

A permit may be transferred to another party under the following conditions:

a. The permittee notifies the Permit Issuing Authority of the proposed transfer;

b. A written agreement is submitted to the Permit Issuing Authority containing the specific transfer date and acknowledgement that the existing permittee is responsible for violations up to that date and the new permittee liable thereafter.

Transfers are not effective if, within 30 days of receipt of proposal, the Permit Issuing Authority disagrees and notifies the current permitttee and the new permittee of the intent to modify, revoke and reissue, or terminate the permit and to require that a new application be filed.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act, (33 U.S.C. 1318) all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Permit Issuing Authority. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act (33 U.S.C. 1319).

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, terminated or revoked for cause (as described in 40 CFR 122.15 et seq) including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. A change in any condition that requires either temporary interruption or elimination of the permitted discharge; or

d. Information newly acquired by the Agency indicating the discharge poses a threat to human health or welfare.

If the permittee believes that any past or planned activity would be cause for modification or revocation and reissuance under 40 CFR 122.15 et seq, the permittee must report such information to the Permit Issuing Authority. The submission of a new application may be required of the permittee.

5. Toxic Pollutants

   a. Notwithstanding Part II (B)(4) above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revoked and reissued or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

   b. An effluent standard established for a pollutant which is injurious to human health is effective and enforceable by the time set forth in the promulgated standard, even though this permit has not as yet been modified as outlined in Condition 5a.

6. Civil and Criminal Liability

   Except as provided in permit conditions on "Bypassing", Part II (A) (6), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

   Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act (33 U.S.C. 1321).

8. State Laws

   Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

11. Permit Continuation

A new application shall be submitted at least 180 days before the expiration date of this permit. Where EPA is the Permit Issuing Authority, the terms and conditions of this permit are automatically continued in accordance with 40 CFR 122.5, provided that the permittee has submitted a timely and sufficient application for a renewal permit and the Permit Issuing Authority is unable through no fault of the permittee to issue a new permit before the expiration date.

C. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during each calendar month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1). Forms shall be submitted at the end of each calendar quarter and shall be postmarked no later than the 28th day of the month following the end of the quarter. The first report is due by the 28th day of the month following the first full quarter after the effective date of this permit.

Signed copies of these, and all other reports required herein, shall be submitted to the Permit Issuing Authority at the following address(es):

Permit Compliance Branch
Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

3. Test Procedures

Test procedures for the analysis of pollutants shall conform to all regulations published pursuant to Section 304(h) of the Clean Water Act, as amended (40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants").

4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The person(s) who obtained the samples or measurements;

c. The dates the analyses were performed;

d. The person(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of all required analyses.

5. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

6. **Records Retention**

The permittee shall maintain records of all monitoring including: sampling dates and times, sampling methods used, persons obtaining samples or measurements, analyses dates and times, persons performing analyses, and results of analyses and measurements. Records shall be maintained for three years or longer if there is unresolved litigation or if requested by the Permit Issuing Authority.

D. DEFINITIONS

1. **Permit Issuing Authority**

The Regional Administrator of EPA Region IV or designee.

2. **Act**

"Act" means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) Public Law 92-500, as amended by Public Law 95-217 and Public Law 95-576, 33 U.S.C. 1251 et seq.

3. **Mass/Day Measurements**

a. The "average monthly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month. It is, therefore, an arithmetic mean found by adding the weights of the pollutant found each day of the month and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Daily Average" or "Monthly Average" in Part I of the permit and the average monthly discharge value is reported in the "Average" column under "Quantity" on the Discharge Monitoring Report (DMR).

b. The "average weekly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and/or measured divided by the number of daily discharges sampled and/or measured during such week. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the week and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Weekly Average" in Part I of the permit and the average weekly discharge value is reported in the "Maximum" column under "Quantity" on the DMR.

c. The "maximum daily discharge" is the total mass (weight) of a pollutant discharged during a calendar day. If only one sample is taken during any calendar day the weight of pollutant calculated from it is the "maximum daily discharge". This limitation is identified as "Daily Maximum," in Part I of the permit and the highest such value recorded during the reporting period is reported in the "Maximum" column under "Quantity" on the DMR.

4. Concentration Measurements

a. The "average monthly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average monthly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar month. This limitation is identified as "Monthly Average" or "Daily Average" under "Other Limits" in Part I of the permit and the average monthly concentration value is reported under the "Average" column under "Quality" on the DMR.

b. The "average weekly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such week (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all samples collected during that calendar day. The average weekly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar week. This limitation is identified as "Weekly Average" under "Other Limits" in Part I of the permit and the average weekly concentration value is reported under the "Maximum" column under "Quality" on the DMR.

c. The "maximum daily concentration" is the concentration of a pollutant discharged during a calendar day. It is identified as "Daily Maximum" under "Other Limits" in Part I of the permit and the highest such value recorded during the reporting period is reported under the "Maximum" column under "Quality" on the DMR.

5. Other Measurements

a. The effluent flow expressed as M^3/day (MGD) is the 24 hour average flow averaged monthly. It is the arithmetic mean of the total daily flows recorded during the calendar month. Where monitoring requirements for flow are specified in Part I of the permit the flow rate values are reported in the "Average" column under "Quantity" on the DMR.

b. Where monitoring requirements for pH, dissolved oxygen or fecal coliform are specified in Part I of the permit the values are generally reported in the "Quality or Concentration" column on the DMR.

6. Types of Samples

a. Composite Sample - A "composite sample" is any of the following:

(1) Not less than four influent or effluent portions collected at regular intervals over a period of 8 hours and composited in proportion to flow.

(2) Not less than four equal volume influent or effluent portions collected over a period of 8 hours at intervals proportional to the flow.

(3) An influent or effluent portion collected continuously over a period of 24 hours at a rate proportional to the flow.

b. Grab Sample: A "grab sample" is a single influent or effluent portion which is not a composite sample. The sample(s) shall be collected at the period(s) most representative of the total discharge.

7. Calculation of Means

a. Arithmetic Mean: The arithmetic mean of any set of values is the summation of the individual values divided by the number of individual values.

b. Geometric Mean: The geometric mean of any set of values is the Nth root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

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OTHER REQUIREMENTS

A. No equipment containing polychlorinated biphenyl compounds shall be placed on site.

B. Effluent discharge structure for outfall serial number 001 shall be designed to assure a miniumum dilution factor of three by the time velocity has decreased to 0.61 mps (2 fps) and a dilution factor of 100 within 30 meters (100 feet) from the point of discharge for all plant discharge conditions at the seven-day, 10-year low river flow. Subsequent to commericial operation of each unit, field measurements (supplemented as necessary with modeling results) shall be conducted to (1) assure conformance with this requirement, (2) determine three-dimensional configuration(s) of thermal and chemical plumes and (3) assure compliance with Kentucky Water Quality Standards requirements. A report detailing compliance shall be submitted by 15 months after the commercial operation date of each unit.

C. Additional monitoring of the cooling tower blowdown (001), stabilized scrubber sludge runoff (002, 003 and 004), and plant intake (008) shall be conducted to assure conformance with applicable water quality standards. Parameters shall include chloride; sulfate; total alkalinity; total hardness; total, dissolved, settleable and susupended solids; and total aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver and zinc. Sampling frequency shall be twice per months for the first six month and once per month for the next 12 months after commercial operation of Unit 1 by grab sample. At the end of this period monitoring shall be continued at a frequency of once per quarter unless more frequent monitoring is determined to be necessary. Data shall be submitted quarterly with other monitoring reports.

D. Discharge from Ponds A, B or C to Waters of the United States is not permitted by this Authorization to Discharge. High level alarms shall be installed to alert control room personnel when water level is within 12 inches of the spillway invert. Records shall be maintained of all periods when water level is within 12 inches of the spillway invert and shall be summarized when submitting DMR's, including the minimum depth to the spillway invert which occurred. In the event that unauthorized discharge occurs, EPA shall be notified in accordance with procedures of Part II.A.3.c. and sampling and analysis of parameters noted in item III.C. shall be expeditiously conducted and reported. Note: No records or reporting are required for periods when water surface is greater than 12 inches below the spillway invert.

E. Permittee shall maintain daily records of rainfall at the site and shall report any periods when rainfall exceeds the 10-year, 24-hour event.

F. Not more than (12) months after the Commericial Operation Date of Unit 1, permittee shall submit representative data as included in 40 CFR Part 122.53 (d)(7)(ii), (iii) and (iv). In the event than any pollutant is present at an unacceptable level, this permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable provisions of the Clean Water Act.

c. **Weighted by Flow Value:** Weighted by flow value means the summation of each concentration times its respective flow divided by the summation of the respective flows.

8. Calendar Day

a. A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

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G. In the event that metal cleaning wastes are removed from site prior to treatment, they shall be adequately treated in an environmentally acceptable manner. Details of such treatment shall be provided to the Director, Enforcement Division not later than 180 days prior to any cleaning operation which will be disposed of off site.

H. The Permittee shall implement a groundwater monitoring program approved by EPA and the State not later than one year prior to operation of Hancock County Unit 1.* Monitoring shall be performed in accordance with the approved plan. Reports shall be submitted to EPA with quarterly Discharge Monitoring Reports.

Should the reports demonstrate significant contamination of groundwater is occurring, the Permittee shall immediately consult with EPA and the Commonwealth and expeditiously institute corrective measures acceptable to EPA and the Commonwealth to mitigate the contamination. These measures may include but are not necessarily limited to: sealing, relocating, or altering operations of the wastewater treatment ponds, ash ponds, scrubber sludge/ash disposal areas, or coal piles. If the reports demonstrate that no significant contamination is occurring, the Permittee after consultation with and approval by the Director, Enforcement Division, may reduce or eliminate the monitoring program.

In the event that changes in the monitoring program become necessary, such changes shall be approved by the Director, Enforcement Division, and the State Director prior to institution.

I. No herbicides shall be used prior to or during initial mechanical clearing of proposed transmission corridors. Corridor maintenance use shall be limited to EPA approved products and in strict acccordance with labelled instructions for use.

J. The Permittee shall implement a construction erosion and sedimentation control program approved by EPA not later than the start of onsite construction.* Monitoring reports shall be submitted quarterly the first year of construction and semiannually thereafter. Erosion and sedimentation control practices shall be consistent with sound engineering practices such as those contained in "Guidelines for Erosion and Sediment Control Planning and Implementation," EPA-R2-72-015 (August, 1972) or "Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity," EPA-430-73-007 (October, 1973).

*A detailed plan shall be submitted prior to issuance of the Final EIS and will be summarized therein.

K. Prior to commencement of onsite construction the Permittee shall undertake and complete all studies and consultations relative to significant onsite archaeological sites that may be effected by construction or operation of the proposed facility. Consultations as specified in 36 CFR 800 may include participation of EPA, the Department of the Interior, the Kentucky Heritage Commission (KHC), and the Advisory Council. Any excavation program will be approved by and conducted under the guidance of the KHC.

Prior to commencement of transmission corridor clearing and tower placement the Permittee shall complete all archaeological surveys and test excavations of the area within the new corridors or the expanded Elizabethtown corridor. The protocol for the survey and, if necessary, excavations must receive prior approval from the KHC.

Previously unidentified archaeological sites uncovered during site preparation or construction activities will be reported to the KHC. The Permittee will not pursue activities which may impact these uncovered sites until the KHC has been able to ascertain their significance.

L. Active disposal area(s) for stabilized scrubber sludge disposal shall not be larger than 10 acres and runoff to the FGD retention ponds shall not be from a total area greater than 30 acres. Active areas shall be expeditiously deactivated by covering with soil and providing a complete vegetative cover. Subsequent to deactivation, runoff shall be diverted from the FGD runoff retention ponds.

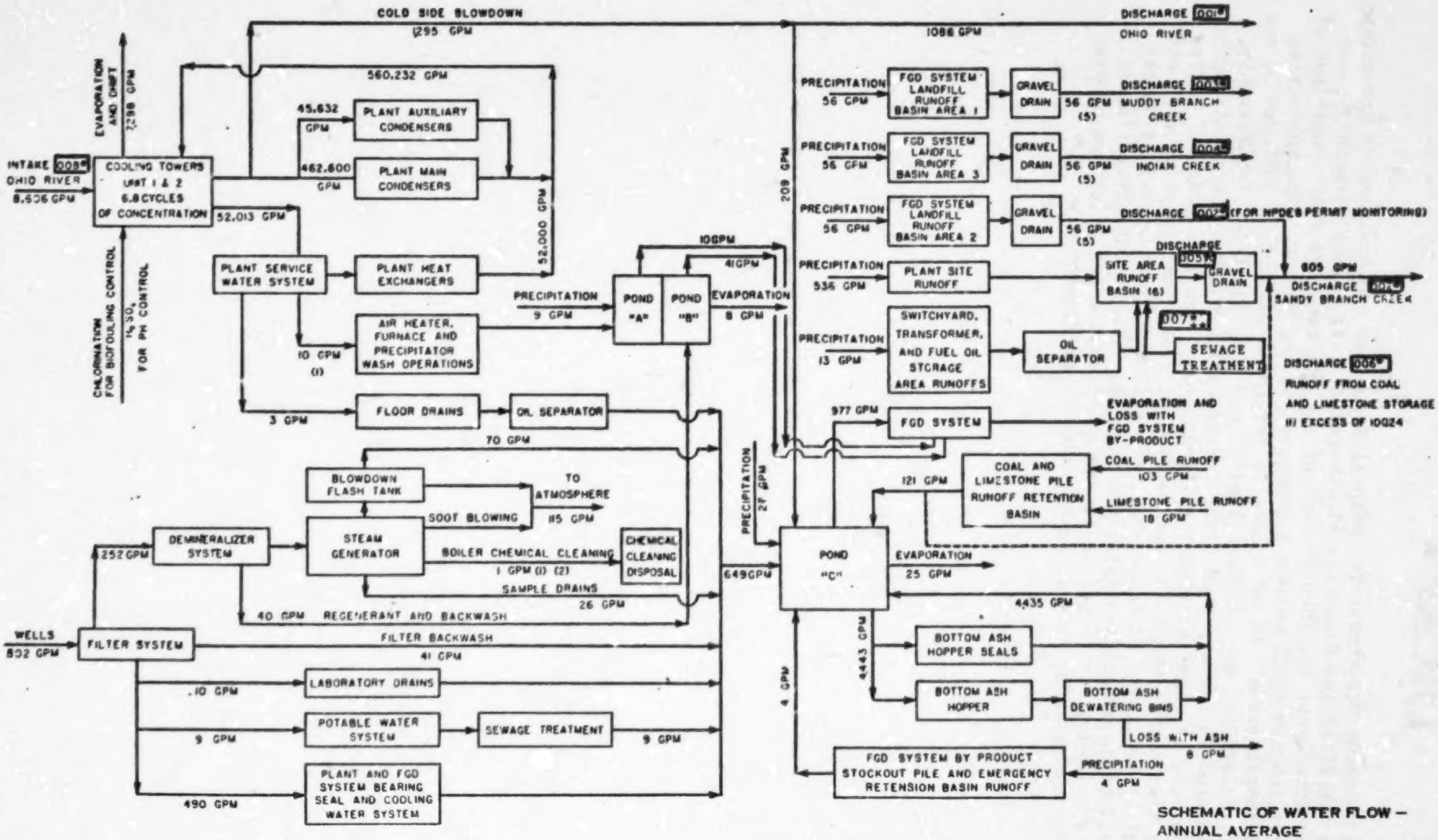
M. The Permittee shall line the wastewater treatment ponds (ponds A, B, and C) with two (2) feet of compacted clay with a permeability not exceeding 10^{-7} cm/sec to reduce potential impacts to the groundwater regime. Not less than 90 days prior to operation of the ponds, certification by an independent laboratory shall be submitted to the Director, Enforcement Division to document compliance with this requirement.

N. Unless a preceding NPDES condition specifies otherwise, the Permittee shall implement its proposed project in complete accordance with the proposed action described in the Draft EIS. This shall not preclude implementation of additional or more stringent conditions required by local or state governmental bodies. Should the applicant desire significant modification to the project, such modification must be approved by EPA prior to initiation.

DRAFT

O. The Kentucky Department for Natural Resources and Environment Protection has certified the discharge(s) covered by this permit with conditions (See Attachment B). Section 401 of the Act requires that conditions of certification shall become a condition of the permit. The monitoring and sampling shall be as indicated for those parameters included in the certification. Any effluent limits, and any additional requirements, specified in the attached state certification which are more stringent supersede any less stringent effluent limits provided herein. During any time period which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits provided herein shall be in effect and fully enforceable. (Note: Certification will be provided prior to permit issuance. Should a certification be provided by ORSANCO, it will be appended as Attachment C.)

Permit No..KY0057606


INTAKE 009*
OHIO RIVER
8,536 GPM
EVAPORATION AND DRIFT
7298 GPM
CHLORINATION FOR BIOFOULING CONTROL
H_2SO_4 FOR PH CONTROL
COOLING TOWERS UNIT 1 & 2 6.8 CYCLES OF CONCENTRATION
COLD SIDE BLOWDOWN
1295 GPM
560,232 GPM
45,632 GPM
PLANT AUXILIARY CONDENSERS
462,600 GPM
PLANT MAIN CONDENSERS
52,013 GPM
52,000 GPM
PLANT SERVICE WATER SYSTEM
PLANT HEAT EXCHANGERS
10 GPM (1)
AIR HEATER, FURNACE AND PRECIPITATOR WASH OPERATIONS
PRECIPITATION
9 GPM
POND "A"
POND "B"
10GPM
41GPM
EVAPORATION
8 GPM
3 GPM
FLOOR DRAINS
OIL SEPARATOR
70 GPM
BLOWDOWN FLASH TANK
TO ATMOSPHERE
115 GPM
SOOT BLOWING
DEMINERALIZER SYSTEM
252 GPM
STEAM GENERATOR
BOILER CHEMICAL CLEANING
1 GPM (1) (2)
CHEMICAL CLEANING DISPOSAL
SAMPLE DRAINS
26 GPM
40 GPM
REGENERANT AND BACKWASH
WELLS
802 GPM
FILTER SYSTEM
FILTER BACKWASH
41 GPM
.10 GPM
LABORATORY DRAINS
9 GPM
POTABLE WATER SYSTEM
SEWAGE TREATMENT
9 GPM
490 GPM
PLANT AND FGD SYSTEM BEARING SEAL AND COOLING WATER SYSTEM
649GPM
PRECIPITATION
27 GPM
208 GPM
1086 GPM
DISCHARGE 001*
OHIO RIVER
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 1
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 003*
MUDDY BRANCH CREEK
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 3
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 004*
INDIAN CREEK
PRECIPITATION
56 GPM
FGD SYSTEM LANDFILL RUNOFF BASIN AREA 2
GRAVEL DRAIN
56 GPM (5)
DISCHARGE 002* (FOR NPDES PERMIT MONITORING)
PRECIPITATION
536 GPM
PLANT SITE RUNOFF
SITE AREA RUNOFF BASIN (6)
DISCHARGE 005*
GRAVEL DRAIN
805 GPM
DISCHARGE 002*
SANDY BRANCH CREEK
PRECIPITATION
13 GPM
SWITCHYARD, TRANSFORMER, AND FUEL OIL STORAGE AREA RUNOFFS
OIL SEPARATOR
007* **
SEWAGE TREATMENT
DISCHARGE 006*
RUNOFF FROM COAL AND LIMESTONE STORAGE (1) EXCESS OF 10Q24
977 GPM
FGD SYSTEM
EVAPORATION AND LOSS WITH FGD SYSTEM BY-PRODUCT
121 GPM
COAL AND LIMESTONE PILE RUNOFF RETENTION BASIN
COAL PILE RUNOFF
103 GPM
LIMESTONE PILE RUNOFF
18 GPM
POND "C"
EVAPORATION
25 GPM
4435 GPM
4443 GPM
BOTTOM ASH HOPPER SEALS
BOTTOM ASH HOPPER
BOTTOM ASH DEWATERING BINS
LOSS WITH ASH
8 GPM
4 GPM
FGD SYSTEM BY PRODUCT STOCKOUT PILE AND EMERGENCY RETENSION BASIN RUNOFF
PRECIPITATION
4 GPM

SCHEMATIC OF WATER FLOW –
ANNUAL AVERAGE
HANCOCK POWER PLANT UNITS 1 & 2
HANCOCK COUNTY, KENTUCKY

*NPDES SERIAL NUMBERS
**During Construction Only

SARGENT & LUNDY
ENGINEERS

JULY 7, 1981

8.2 PSD DETERMINATION

A preliminary determination regarding the Prevention of Significant Deterioration (PSD) permit was issued on October 12, 1979, and a public hearing was held on July 22, 1980. Since the public hearing, additional information has been submitted for the PSD record. Consequently, a public notice (announcing the re-opening of the public comment period for review and comment on this new information) was issued on August 20 and 27, 1981. The comment period for the new information is for 21 days. Following the close of the PSD comment period, a final determination on the PSD permit will be formulated.

8.3 UNITED STATES FISH AND WILDLIFE SERVICE
BIOLOGICAL OPINION

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PLATEAU BUILDING, ROOM A-5
50 SOUTH FRENCH BROAD AVENUE
ASHEVILLE, NORTH CAROLINA 28801

June 4, 1981

Mr. Daris J. Dal Santo
EIS Project Officer
U.S. Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

RE: 4-2-81-020

Dear Mr. Dal Santo:

We have reviewed the biological assessment on the endangered species impacts of Kentucky Utilities' proposed construction of a new generating station in either Hancock or Breckinridge County, Kentucky, submitted for our review on March 30, 1981. We apologize for the delay in providing a timely response to your assessment and appreciate the extension of time to June 10, 1981, to comment on the assessment.

The biological assessment is adequate and supports the conclusion of "no effect." In view of this, we believe that you have satisfied the requirements of Section 7 of the Endangered Species Act. Since we do not anticipate that this proposal will affect any listed species, formal consultation under Section 7 is not necessary and issuance of a formal biological opinion is not required.

Your interest and initiative in enhancing Endangered and Threatened species is appreciated.

Sincerely yours,

William C. Hickling
Area Manager

8.4 STATE HISTORIC PRESERVATION OFFICERS

HISTORICAL AND ARCHAEOLOGICAL DETERMINATIONS

COMMONWEALTH OF KENTUCKY

Kentucky Heritage Commission
104 Bridge Street
Frankfort, Kentucky 40601

May 13, 1981

Robert B. Howard, Chief
EIS Preparation Section
U.S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Howard:

Thank you for providing the information I requested concerning outbuildings associated with structure 17 at Kentucky Utilities' Holt Bottoms plant site in Breckinridge County, Kentucky. Since the garage and barn are less than 50 years old, structure 17 and its associated outbuildings are not eligible for listing in the National Register of Historic Places.

Yours very truly,

Anne Armstrong Thompson

(Mrs.) Anne Armstrong Thompson
Executive Director and
State Historic Preservation Officer

cc: Don Klima, Advisory Council for Historic Preservation
Joseph Beard, Kentucky Utilities

AAT:klw

COMMONWEALTH OF KENTUCKY

Kentucky Heritage Commission
104 Bridge Street
Frankfort, Kentucky 40601

April 15, 1981

Mr. Robert B. Howard, Chief
Environmental Impact Statement Section
U.S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Howard:

Thank you for your letter of March 18 concerning Kentucky Utilities' proposed plant sites in Breckinridge and Hancock counties and the Elizabethtown Transmission Corridor. Mr. Joseph Beard of Kentucky Utilities has submitted, on behalf of the Environmental Protection Agency, additional inventory forms and photographs prepared by Normandeau Associates, Inc. as requested in our letter of February 9. We have reviewed these materials and our recommendations are as follows:

Breckinridge County Proposed Plant Site

Structures 13, 14, 15 and 18, located in the proposed Breckinridge County Plant site, do not meet the minimum criteria for inclusion in the National Register of Historic Places. Therefore, they warrent no further consideration. The status of structure 17 for listing in the National Register of Historic Places remains undetermined since the additional information requested on its possible association with significant outbuildings was not provided.

Elizabethtown Transmission Corridor

Our review of the documentation supplied for the Elizabethtown Transmission Corridor indicates that the following structures do not meet the minimum criteria for inclusion in the National Register of Historic Places: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14 and 15. The only structure within the corridor which is eligible for listing in the National Register of Historic Places is structure 10, the Stamper Pirtle House.

With the exception of structure 17 at the proposed Breckinridge County plant site, the State Historic Preservation Officer has applied the National Register criteria to all standing structures identified by Kentucky Utilities at the proposed Breckinridge County plant site, the proposed Hancock County plant site and the Elizabethtown Transmission Corridor (enclosure). The proposed Hancock County plant site contains no structures included in or eligible for inclusion in the National Register of Historic Places and, in the opinion of the State Historic Preservation Officer, the existing structures at that site warrant no further consideration. The Elizabethtown Transmission Corridor contains one structure, structure 10, which is considered eligible by the State Historic Preservation Officer. At the proposed Breckinridge County plant site, the Joseph Holt Memorial Chapel and House are listed in the National Register of Historic Places. However, the State Historic Preservation Officer has determined that no additional structures are present which meet the minimum criteria for listing in the National Register. In accordance with the Advisory Council's Regulations for the Protection of Historic and Cultural Properties (36 CFR, Part 800.4) the Environmental Protection Agency should request a determination of eligibility from the Secretary of the Interior's designee, the Keeper of the National Register of Historic Places, Heritage Conservation and Recreation Service, 19th and C Streets, N.W., Washington, D.C. 20240. You may use this letter and enclosure concerning significance as evidence of consultation with the State Historic Preservation Officer.

Upon receipt of the information requested for structure 17 at the Breckinridge County plant site, the State Historic Preservation Officer will apply the National Register criteria, thus completing this stage of the review process for the standing structures. For each property listed in or determined eligible for listing in the National Register by the Keeper of the Register, the Environmental Protection Agency, in consultation with the State Historic Preservation Officer, shall apply the Criteria of Effect.

Per your request for suggestions on phrasing of a condition to the NPDES permit concerning the treatment of cultural resources, I offer the following comments. I would recommend that the first paragraph which deals with the Permittee's responsibilities to conduct archaeological excavations at "all significant on-site cultural sites (as identified by the Kentucky Heritage Commission)" be rephrased to emphasize that the Permittee must abide by the terms of any Memorandum of Agreement reached between EPA, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation. A Memorandum of Agreement is not necessarily limited to archaeological excavations and may specify other conditions such as avoidance or preservation of sites.

In the second paragraph dealing with archaeological surveys within the transmission corridor, I would recommend that the term "excavations" in line three be changed to "test excavations". This change should be made to distinguish between "testing" which is performed to assess eligibility for listing in the National Register of Historic Places and "excavation" which may be performed as mitigation of Adverse Effect under the terms of a Memorandum of Agreement. As you correctly state, the format for the survey and testing phase is subject to review and approval by the State Historic Preservation Officer.

The third paragraph dealing with resources discovered during construction and the fourth paragraph outlining EPA's responsibilities to initiate any consultation procedures with the Secretary of the Interior and the Advisory Council appear to be appropriately phrased.

We look forward to reviewing and approving the remaining archaeological survey and testing reports for this project which are to be prepared after the Draft EIS is issued. Should you have any questions concerning my opinions on the standing structures or my comments on appropriate wording for the permit condition, please feel free to contact Thomas Sanders or me at 502/564-3741.

Very truly yours,

Anne Armstrong Thompson

(Mrs.) Anne Armstrong Thompson
Executive Director and
State Historic Preservation Officer

AAT/TNS/jap

enclosure

cc: Mr. Don Klima, Advisory Council
Mr. Joseph Beard, Kentucky Utilities

Statement of the opinion of the State Historic Preservation Officer concerning the eligibility of a property for inclusion in the National Register.

I understand that the Environmental Protection Agency is requesting
agency
the opinion of the State Historic Preservation Officer concerning the eligibility of Stamper Pirtle House for inclusion in the
property(ies)
National Register and that my opinion may be submitted to the Secretary of the Interior with a formal request for a determination of eligibility on this property. This statement confirms my consultation as part of the determination of eligibility procedures.

X (1) In my opinion, the property is eligible for inclusion in the National Register.

____ (2) In my opinion, the property is not eligible for inclusion in the National Register.

____ (3) I have no opinion and prefer to defer to the opinion of the Secretary of the Interior.

Justification and comments:

The house, located in rural Hardin County, is an intact frame two-story vernacular I house with features characteristic of the Victorian period. The exterior appears unaltered, with brackets around the cornice, pedimented hoods over all bays on the main facade. Over the central-entrance is a two-story portico, with an entrance onto the balcony at the second level--somewhat Greek Revival in feeling. The dwelling represents an effective adaptation of Victorian revival stylistic features to the common I house plan found in rural Hardin County.

Signed: Anne C. Thompson
State Historic Preservation Officer

Kentucky Heritage Commission
104 Bridge Street
Frankfort, Kentucky 40601

February 9, 1981

Mr. Robert B. Howard, Chief
Environmental Impact Statement Section
United States Environmental
Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Howard:

Thank you for your correspondence of January 20 concerning Kentucky Utilities proposed plant sites in Breckinridge and Hancock counties. Our review of the proposed Breckinridge site indicate structures 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 16 and 19 do not meet the minimum criteria for inclusion in the National Register of Historic Places. Therefore, no additional work is necessary for these sites in Breckinridge County. However, we will need additional information on the following structures in Breckinridge County before we can evaluate their eligibility:

Structure 14: No photograph was provided. We will need a photograph in order to assess the structure's eligibility for inclusion in the National Register of Historic Places.

Structure 13: We need a completed historic site inventory form (Attachment). The form should address the structure's association, if any, with the Addison Lock and Dam. We need an additional photograph of the structure. The photograph should be a frontal shot.

Structure 15: We need a completed historic site inventory form.

Structure 17: Are there any significant outbuildings associated with the structure?

Structure 18: We need a completed historic site inventory form with information on the interior if possible.

When we receive the additional information, we will expedite our review to determine if these structures are eligible for inclusion in the National Register of Historic Places. As you know, the Joseph Holt Memorial Chapel and House are included in the National Register of Historic Places.

Structures located on the Hancock County project site which do not meet the minimum criteria for inclusion in the National Register of Historic Places are #'s 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24. These structures warrent no additional consideration.

My staff and I have reviewed the proposed Elizabethtown Transmission Corridor. We will need an historic site inventory form on each of the structures. We need clear photographs of #'s 2, 5 and 10. An archaeological survey should be conducted on the proposed transmission route on all previously undisturbed land (existing highway right-of-way, paved city streets, etc., need not be surveyed) to determine if there are any sites eligible for inclusion in the National Register of Historic Places.

We look forward to reviewing and approving the remaining archaeological survey and testing reports for the Breckinridge and Hancock project sites (Attachment). Should you have any questions, feel free to contact Tom Sanders of my staff at (502) 564-3741.

Very truly yours,

Anne Armstrong Thompson

(Mrs.) Anne Armstrong Thompson
Executive Director and
State Historic Preservation Officer

jap

attachments

cc: Mr. Charles Beard
Mr. Don Klima

Kentucky Heritage Commission
104 Bridge Street
Frankfort, Kentucky 40601

September 2, 1980

Mr. John Beard
Kentucky Utilities
One Quality Street
Lexington, Kentucky 40507

Dear Mr. Beard:

The Kentucky Heritage Commission has reviewed the Cultural Resource Assessment of Two Alternate Locations of the Hancock Power Plant, Hancock and Breckinridge Counties, Kentucky. Our review indicates 23 structures in Hancock County and 12 structures in Breckinridge County, in addition to the Joseph Holt House and Chapel listed in the National Register of Historic Places in 1976, are located in your proposed project alternatives. Our historic site surveys are ongoing and incomplete for these two counties. Therefore, a photograph of each structure (50 years or older) to be effected permanently (either visually or physically) by the proposed construction should be forwarded to this office. A historic site survey form should be completed (Items 1-22) and submitted with the photographs for our review and comment (enclosure). This information will assist this office in determining if there are any structures in your project area eligible for inclusion in the National Register of Historic Places, as outlined in the Advisory Council's Regulations for the Protection of Historic and Cultural Properties (36 CFR, Part 800; enclosure)

The archeological reconnaissance survey of the Hancock County site (Skillman Bottoms) identified 95 archeological sites in the proposed project area. The field investigators recommend testing 31 sites (15 Ha-100, -102, -103, -104, -107, -111, -114, -116, -117, -118, -124, -131, -138, -144, -146, -147, -148, -149, -151, -153, -154, -155, -156, -159, -160, -170, -174, -180, -181, -182, -188) to determine if they are eligible for inclusion in the National Register of Historic Places. In my staff's opinion, 15 Ha-150 and 15 Ha-152 have the potential for deeply buried deposits and should be evaluated further by systematic backhoe trenching to determine if these sites are eligible for inclusion in the National Register of Historic Places. Therefore, we recommend additional archeological work for the 31 sites identified by the field investigators and 15 Ha-150 and 15 Ha-152. We concur with the field investigator's recommended testing program. The testing program will establish if any of the 33 sites identified in the reconnaissance survey are eligible for inclusion in the National Register of Historic Places.

Our review of the Breckinridge County Site (Holt Bottoms) Archeological Survey indicates that the proposed boundaries of the project area have shifted. Consequently, the following sites identified in the survey report are outside of the current proposed project area:

1. The Holt Bottoms Archeological District listed in the National Register of Historic Places in 1978.
2. 15 Bc-37, -39, -40, -41, -42, -43, -51, -63, -64, -72 and -76; if the project boundaries are changed in the future to incorporate these sites, additional work would be needed in order to assess their eligibility for inclusion in the National Register of Historic Places.
3. 15 Bc-38, -44, -45, -46, -47, -48, -49, -50, -52, -53, -54, -55, -56, -57, -58, -59, -60, -61, -62, -65, -66, -67, -68, -69, -70, -71, -73, -74, -75, -77, -78, -79, -80, -81, -82, -83 and -95; should the boundaries of the project area be changed to incorporate these sites, no further work will be necessary. These sites are not eligible for inclusion in the National Register of Historic Places.

The reconnaissance survey identified five sites (15 Bc-19, -90, -93, -98 and -99) in the current project boundaries which require further archeological work to determine if they are eligible for inclusion in the National Register of Historic Places. We concur with the author's recommended testing strategies. Site numbers 15 Bc-84, -85, -86, -87, -88, -89, -91, -92, -94, -96, -97, -100, -101 and -102 require no further archeological work. There are 851 acres on the Breckinridge alternative which have not been surveyed because Kentucky Utiliites could not gain owner permission. These areas must be surveyed prior to final site selection to determine if there are any sites eligible for inclusion in the National Register of Historic Places. The State Historic Preservation Officer must review and approve the survey report.

We look forward to reviewing the historic site information for the proposed project area. Should you have any questions, feel free to call Marcia Richmond of my staff at 502/564-4452.

Sincerely,

Donna C. Hopkins

(Mrs.) Donna C. Hopkins
Acting Executive Director and
Acting State Historic Preservation Officer

Enclosures

cc: Ms. Nancy O'Malley, University of Kentucky
Mr. Robert B. Howard, U.S. Environmental Protection Agency

DCH:klw

STATE of INDIANA

1816

INDIANAPOLIS, 46204

DEPARTMENT OF NATURAL RESOURCES

JAMES M. RIDENOUR
DIRECTOR

April 20, 1981

Robert B. Howard
U.S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Howard:

I am writing in regard to additional information which you submitted regarding the Kentucky Utilities Hancock Generating Station.

The I. E. Bland Residence, Structure #9, is a one and one-half story frame Carpenter Gothic house, and it is our opinion that this structure is eligible for the National Register on the basis of its architectural merit. The Hancock site will have no impact on the Bland Residence, and there will be no adverse impact from the Breckinridge site. The Wilbur House, Structure #10, is a two-story frame, Italianate house with a truncated hip roof, brackets and corner quoins. The use of the quoins on a frame house is fairly unusual in Indiana. It is our opinion that this structure is also eligible for the National Register on the basis of its architectural merit. The Hancock site will have no adverse impact on the Wilbur House, and the Breckinridge site will have no impact on the structure.

We are returning the National Register nomination forms for Lafayette Spring and the Mason House. We suggest that the Environmental Protection Agency use the normal procedures for submitting the documentation to the Department of the Interior for a determination of National Register eligibility, rather than apply to have the properties directly listed on the National Register. As you may know, the listing process is sometimes lengthy, and at this time we are unable to process applications for privately owned properties due to a change in the federal preservation law and the freeze on new federal regulations. Since it would most likely be late fall before the nomination process could be completed, we suggest that you submit the properties for a determination of eligibility under either the 45 or 10 day process. When you submit the documentation to the Department of the Interior, you should include copies of this letter and our letter of January 29, 1981.

"EQUAL OPPORTUNITY EMPLOYER"

Please do not hesitate to contact Richard Gantz of my staff at the Division of Historic Preservation (317-232-1646) should you have any questions regarding this matter.

Very truly yours,

John T. Costello

James M. Ridenour
Director
Department of Natural Resources

JMR:rgr

STATE of INDIANA

1816

INDIANAPOLIS, 46204

DEPARTMENT OF NATURAL RESOURCES

DIRECTOR
James M. Ridenour

January 29, 1981

Robert B. Howard
Chief of the E.I.S. Preparation Section
U.S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30308

Dear Mr. Howard:

We have reviewed the information which you submitted regarding the proposed Kentucky Utilities' Hancock County Generating Station, which may impact structures and sites in Perry County, Indiana.

Of the ten properties cited in your letter, it is our opinion that Lafayette Spring is eligible for the National Register of Historic Places on the basis of its historical associations with Lafayette's visit to America in 1824. The two story Italianate style house (#4) in our opinion retains sufficient architectural merit to qualify it for inclusion in the National Register.

It is our opinion that properties numbered 1, 2, 3, 5, 6, 7, and 8 do not possess sufficient merit to qualify for inclusion in the National Register. The photographs and descriptions for properties 9 and 10 were not of a good enough quality to accurately evaluate. It is our opinion that the Hancock site would have no adverse impact on the Italianate house (#4) or Lafayette Spring (#2). We believe there would be no impact on the Lafayette Spring and the Italianate house from the Breckonridge site.

We would not be able to comment further on the likely impacts, if any, on structures #9 and #10, without additional photographs and descriptions.

Please do not hesitate to contact us when we may of further service regarding this project.

Very truly yours,

John T. Costello

James M. Ridenour
State Historic Preservation Officer

JMR:RAG:dmp

"EQUAL OPPORTUNITY EMPLOYER"

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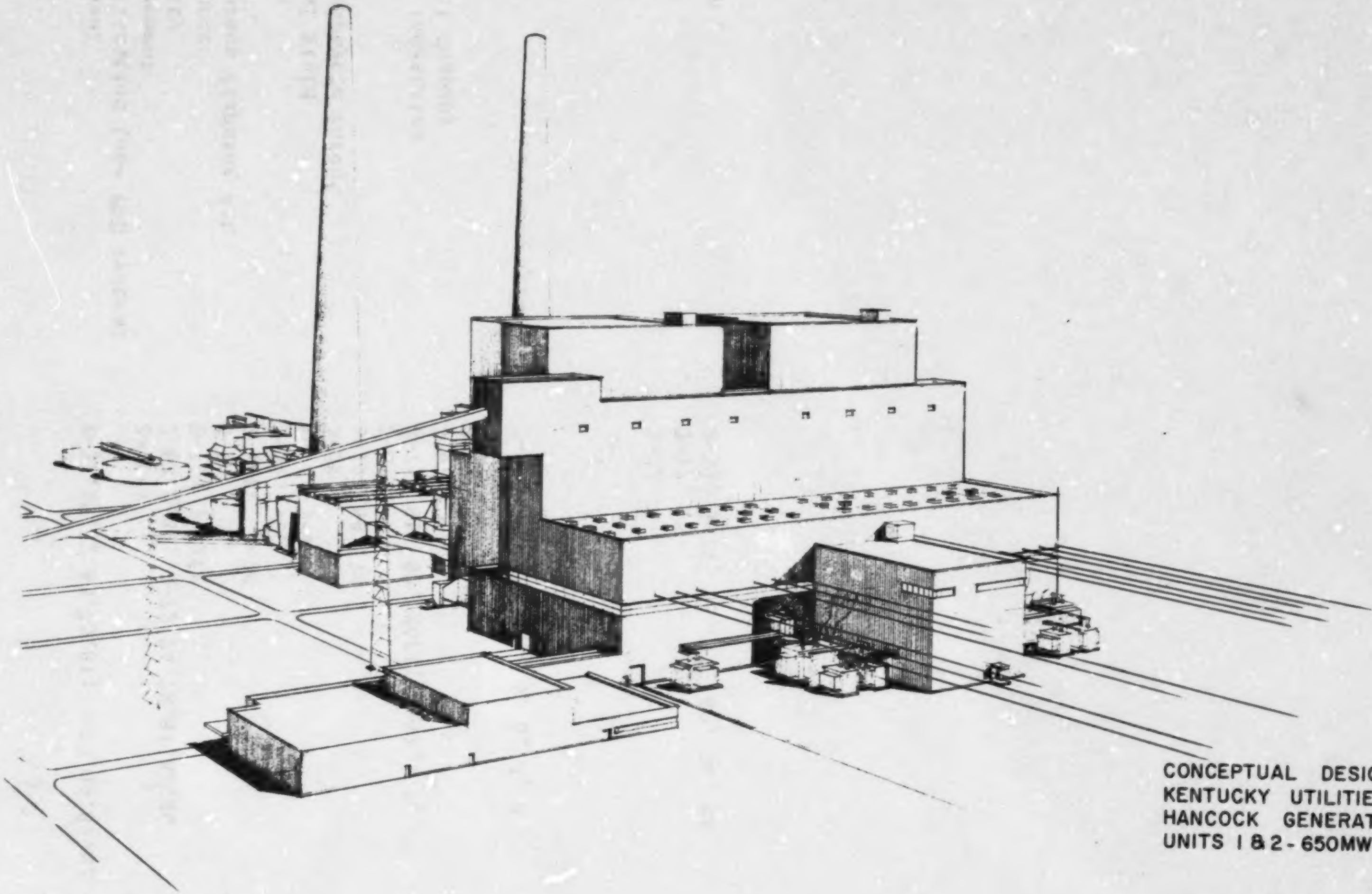

CONCEPTUAL DESIGN
KENTUCKY UTILITIES COMPANY
HANCOCK GENERATING STATION
UNITS 1 & 2 - 650MW (NET) EACH

SARGENT & LUNDY